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Alternating Current Bridge Measurements

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A REVIEW OF fundamentals for making direct-current resistance measurements through the use of the Wheatstone bridge principle. Its application to alternating current circuits for measurement of self-inductance, mutual inductance, capacitance

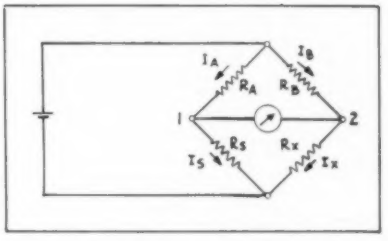

Fig. 1. Circuit for simple Wheatstone Bridge.

ALTHOUGH there may be some hesitancy in admitting it, it is true, nevertheless, that much of the progress made in telephony in past years has been through the time-honored method of trial and error, or just plain cut and try. This is no reflection on telephone people at all; probably no group has been so handicapped by the lack of adequate measuring equipment.

Of course, the Wheatstone bridge has been available since before the origin of the telephone industry, and it has served many and varied purposes quite well.

In its simplest form, however, only direct-current measurements are possible, and it is at once recognized that the usefulness of such measurements is limited. For instance, an iron-cored coil does not have the same *effective resistance* at voice frequencies as it offers to direct current. Thus, direct-current resistance measurements may prove misleading when such a coil is used in voice-frequency alternating-current circuits.

The principle of the simple Wheatstone bridge can easily be extended to alternating-current circuits. It is the purpose of this article to show certain of these alternating-current applications. With an alternating-current bridge available, and with its application clearly understood, much guess work can be eliminated.

The treatment requires from the outset certain derivations. These are quite simple, however, and the reader will find no difficulty with them if the wording is followed carefully.

Wheatstone Bridge Equations

The circuit for the simple direct-current Wheatstone bridge is shown in Fig. 1. In such a bridge R_A and R_B are usually considered the ratio arms, R_S the standard resistor, and R_X the unknown to be measured. When the bridge is adjusted to balance by varying R_A, R_B, and R_S, then no current flows through the indicating galvanometer at the center of the bridge. It can, therefore, be said that I_A equals I_S, and I_B equals I_X.

Now, if no current flows through the galvanometer, this means that there is no difference of voltage across it; that is, points 1 and 2 must be at the same potential. It must follow then that the voltage drop, I_AR_A, equals the voltage drop, I_BR_B, and that the drop, I_SR_S, equals I_XR_X. If this were not true, then the points 1-2 would not be at the same potential, and the galvanometer would conduct a current and would show a deflection.

When these relations are written as equations, then $I_AR_A = I_BR_B$, and $I_A/I_B = R_B/R_A$. Also, $I_SR_S = I_XR_X$, and $I_S/I_X = R_X/R_S$. But as was shown, $I_A = I_S$ and $I_B = I_X$, and thus it can be written that $I_A/I_B = R_X/R_S$. The two resistance ratios are now expressed as the *same* current ratio, so the fundamental

Wheatstone bridge equation can now be written as

$R_B/R_A = R_X/R_S$, or that

$$R_X = R_S R_B/R_A \quad \ldots\ldots\ldots\ldots (1)$$

Alternating Current Bridge Relations

The equations just derived were for the simple direct-current bridge, but these can easily be extended to alternating-current measurements. To do this a few simple steps rather than an elaborate proof will be given.

In discussing Fig. 1, it was stated that R_A and R_B were often considered as ratio arms. Let it now be assumed that they are the same value, say 1,000 ohms each, then equation 1 becomes $R_X = R_S$. In other words, for this assumed condition if a balance is to be obtained, then R_S must be chosen equal to R_X. Whatever is in the unknown arm (from a direct-current standpoint) must be placed in the opposite arm if a balance is to be obtained. This theory can be extended to the alternating-current bridge.

Such a bridge is shown in Fig. 2. The battery has been replaced by a buzzer, or better, a vacuum-tube oscillator, and a telephone receiver or a pair of headphones is used instead of the galvanometer. The ratio arms R_A and R_B are identical as before, but instead of a pure resistance in the unknown arm (to be measured), resistance R_X and inductance L_X now appear.

Extending the theoretical conclusions of the preceding paragraph, for identical ratio arms R_A and R_B, the value of the standard inductance L_S must equal the inductance of the unknown L_X; and similarly, R_S and R_X must be equal for a minimum tone to be heard in the headphones.

In many instances the capacitance of condensers rather than the inductance of coils is to be measured. For these the same reasoning applies; if C_X is the value of the unknown condenser, then C_S must be a condenser of equal capacitance for a balance to be obtained.

Bridges With Unequal Ratio Arms

Thus far only unity ratio arms have been considered, but such equal arms are usually the exception rather than the rule. It is apparent that with their use, widely variable standards of inductance L_S and capacitance C_S would be necessary to measure a variety of unknowns. It is with the use of *unequal* rather than equal ratio arms to extend the range of a bridge that explanation is needed.

To generalize the Wheatstone bridge for alternating-current measurements, let equation 1 be written

$$R_B/R_A = R_X/R_S = Z_X/Z_S = (R_X + jX_X)/(R_S + jX_S) \ldots (2)$$

This notation will need a word of explanation for some readers. The letter j written before X_X and X_S merely means that the value it precedes is at right angles to the resistance values R_X and R_S. It will be recalled that in alternating-current work, resistance and reactance values are at right angles as Fig. 3 indicates, and that they must be so added to find the impedance Z. But for purposes of algebra, it is conventional to precede the reactances with the letter j, which means that

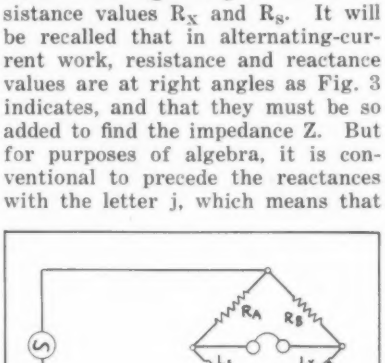

Fig. 2. An adaptation of the simple Wheatstone Bridge to the measurement of inductance.

the reactance is at right angles. Mathematically, the symbol

$$j = \sqrt{-1}, \text{ and } j^2 = -1.$$

Perhaps before proceeding it also would be well to review certain other fundamentals. Thus, the *reactance* of a coil is $X_L = 2\pi fL$, where X_L is in ohms when f is the frequency of the current through the coil in cycles per second, and L is the inductance of the coil in henrys. Similarly, the reactance of a condenser is $X_C = 1/2\pi fC$, where X_C is in ohms when f is the frequency in cycles per second and C is the capacitance in farads.

Another important fact is that inductive reactance and capacitive reactance act oppositely in circuits. Thus, if equal amounts are connected in series, they will neutralize each other and produce resonance at some given frequency.

Returning now to equation 2, this relation shows that (as was previously demonstrated) for equal ratio arms the unknown and the standard must be identical. For unequal arms, the relation

$R_B/R_A = (R_X + jX_X)/(R_S + jX_S)$ holds.

This relation as it stands is of little value, however, because resistance must be balanced by resistance, and reactance by a similar reactance placed in the opposite arm of the bridge.

To obtain the useful equations, this relation may be written:

$$\frac{R_B}{R_A} = \frac{R_X + jX_X}{R_S + jX_S} \text{ or}$$

$$R_B R_S + R_B jX_S = R_A R_X + R_A jX_X.$$

Separating the terms containing only pure resistance, and those containing only pure reactance (because as previously stated, only resistance can balance resistance, and only reactance can balance reactance),

$$R_B R_S = R_A R_X \text{ and}$$

$$R_X = R_B R_S/R_A \ldots\ldots\ldots (3)$$

Also, $R_B jX_S = R_A jX_X$ and

$$X_X = R_B X_S/R_A \ldots\ldots\ldots (4)$$

since the j values cancel.

Equations 3 and 4 are the desired bridge equations, and equation 4 can be written in the more useful forms

$$2\pi fL_X = R_B 2\pi fL_S/R_A \text{ or}$$

$$L_X = R_B L_S/R_A \ldots\ldots\ldots (5)$$

and

$$1/2\pi fC_X = R_B(1/2\pi fC_S)/R_A \text{ or}$$

$$C_X = R_A C_S/R_B \ldots\ldots\ldots (6)$$

Note that in these two equations the effect of the ratio arms is reversed.

The Measurement of Self-Inductance

The equations applying to the alternating-current bridge of Fig. 2 were derived in the preceding section; in this section their application will be considered. Before this is done, however, it will be well to briefly review certain electrical fundamentals applying to coils.

The self-inductance of a coil is a fundamental property built into the coil when it is wound. The self-inductance causes an opposing voltage to be induced in the coil whenever a change is made in the current flowing through the coil. Self-inductance can be computed by the expression

$$L = N\phi/10^8 I \ldots\ldots\ldots (7)$$

where L is in henrys, N is the number of turns of wire and ϕ is the magnetic lines of force linking the coil and produced by a current of I amperes. Self-inductance is, therefore, the flux linkage per unit current.

When the coil is isolated from metallic objects and has an *air* core, the inductance is independent of the magnitude of the current. The measured resistance of an air-cored coil will be about the same as the direct-current resistance when measurements are made at voice frequencies.

If the coil is close to metallic objects or has a metallic core, then these relations do not hold. If the core is of iron or some other magnetic material, the flux produced per unit current, and hence the in-

ductance, depends for a given coil on the current magnitude, because of the magnetic saturation of the core. Also, the hysteresis and eddy-current losses in a coil with a core of magnetic material will depend on the magnitude of the test current and upon its frequency.

These losses take power from the source of the test current, and they cause the effective or alternating-current resistance of such a coil to be different from its direct-current resistance.

Returning now to Fig 2, the actual measurement of inductance will be discussed. The treatment will be limited to coils designed to carry *only* alternating current; the measurement of the inductance of coils carrying simultaneously direct and alternating current will be considered in a later article to appear in TELEPHONY.

If L_X and R_X represent the self-inductance and resistance of an *air-cored* coil, they can be measured as indicated in Fig. 2. The standard inductance L_S can be fixed in value or can be a variable inductance. Its resistance must be known and must be added to R_S of equation 3.

The adjustment for balance (least tone in the headphones) is made by varying (either or all) R_A, R_B, L_S, and R_S. If a sharp balance is not obtained, it indicates that further adjustments are necessary. Equations 3 and 5 should be used.

If L_X and R_X represent the self-inductance and effective resistance of a coil with a magnetic core, then the same method is used. Since these values may vary with the magnitude and frequency of the test current, these should be chosen typical of the conditions of operation for the coil. Ordinarily such precautions are not necessary. In most telephone circuits the current magnitude is quite small and thus, if an ordinary vacuum-tube oscillator of about 1,000 cycles is used, the measured values will be reliable. This assumes that the output of the oscillator is of the same order of magnitude as the current under working conditions.

The Measurement of Mutual Inductance

In the preceding paragraphs a standard inductance was used for the measurement of inductance, but standard condensers also may be used; the term standard implying any suitable, calibrated condensers. These measurements are made with unity ratio arms.

Thus in Fig. 2, instead of connecting a standard inductance at L_S, a standard condenser, C_S, would be connected *in series* with L_X, and the bridge would be balanced by varying R_S and C_S. A balance is possible, because, as mentioned in a preceding section, at any frequency a given value of capacitance will neutralize the reactance of a coil; and when this occurs, the circuit of the coil and condenser in series appears as if it were only pure resistance. For such a unity-ratio bridge,

$$2\pi fL_X = 1/2\pi fCS, \text{ and}$$
$$L_X = 1/(2\pi f)^2 C_S \ldots\ldots (8)$$

In this expression L_X will be in henrys when f is the frequency in cycles per second, and C is the capacitance in farads.

The mutual inductance between two coils is the property which causes a voltage to be induced in one coil by a current change in the other. This can be readily measured on the bridge of Fig. 2 using a standard inductance and unity ratio bridge arms. To do so, the two coils *in series* are connected in place of L_X and R_X. The series inductance of the two coils is measured with the coils aiding, and then with them opposing. The mutual inductance will be one-fourth of the difference between these two values.

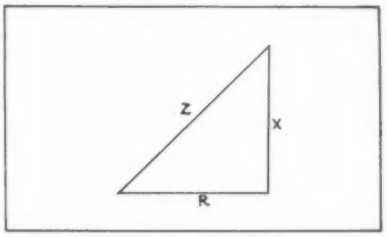

Fig. 3. Resistance, R, and reactance, X, combine at right angles to give impedance, Z.

The aiding and opposing connections should not prove confusing, since these are the only two possible series connections. When connected aiding (that is, so the magnetic flux-producing tendencies of the two coils add) the voltage generated between the two ends of the circuit (and hence the total series inductance L) is proportional to $L_P + L_S + 2M$, where L_P and L_S are the primary and secondary inductances, and M is the mutual inductance.

When they are connected opposing, then the voltage (and the series inductance L′) is proportional to $L_P + L_S - 2M$. Subtracting this last relation from the first shows that

$$4M = L - L' \text{ and that}$$
$$M = (L - L')/4 \ldots\ldots (9)$$

It is also necessary to balance the resistance component to obtain a minimum tone, but ordinarily this value is not useful.

These measurements are usually much more easily made than are inductance determinations, because, for most work the losses in condensers are so small as to be negligible. Thus, for most capacitance measurements R_S and R_X do not appear in Fig. 2, the bridge consisting merely of the standard condenser C_S instead of L_S, and the unknown condenser C_X instead of L_X. For a balance, obtained by varying either (or all) R_A, R_B, or C_S, the capacitance of the unknown is given by equation 6.

The Measurement of Capacitance

In the capacitance measurements just explained a standard, or calibrated, condenser was used, but it may be desired to use a standard inductance instead. This is done with equal ratio arms because it depends on producing resonance with the unknown just as was explained under the measurement of inductance.

Thus in Fig. 2 the standard inductance and the unknown capacitance would be connected in series in the arm marked L_X, R_X, and only the resistor R_S would appear in the opposite arm. This resistor is necessary to balance the resistance of the standard inductance. To obtain a balance of the bridge the inductive and capactive reactances must be equal, or

$$2\pi fL_S = 1/2\pi fC_X, \text{ and}$$
$$C_X = 1/(2\pi f)^2 L_S \ldots\ldots (10)$$

when L_S is in henrys, C_X will be in farads.

Conclusions

It is surprising how wide a range of reliable measurements can be made with a small amount of equipment. Of course, the variable resistors or resistance boxes must be suitable for alternating-current use. Also, the more precise these are, the greater the degree of accuracy. This same statement applies to the standards used.

In many instances a stage or two of amplification between the bridge and the headphones may be advisable; also, a tuned amplifier, or filters in the input, will be of value in reducing the effect of harmonics. In balancing the bridge, the observer must learn to concentrate on the fundamental and forget the harmonics he may hear.

And in conclusion, the observer should not be discouraged with apparent failure and lack of reliability when first making extensive bridge measurements. Just as in any other work, experience in such measurements must go hand in hand with theoretical knowledge.

In the Nation's Capital

By FRANCIS X. WELCH

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WIRE-TAPPING BILLS passed by House and Senate but died with the session. . . . Text of bill as finally passed by House gave power for heads of government agencies to authorize wire tapping, and comments as to the government bureaus which would have the wire-tapping authority. . . . Purposes for which wire tapping is used and the "certification" joker in the proposed bill. . . . Some phases of wire tapping in Washington discussed by FBI official

IT SEEMS strange that just at a time when such effort was being made at Albany, N. Y., to put into the new state constitution a plank outlawing court use of evidence obtained by wire tapping, a powerful drive was under way here in Washington to amend the Communications Act of 1934 so as to get around a U. S. Supreme Court decision which already outlaws such evidence in the Federal courts.

Stranger still, perhaps, is the fact that in New York state the advocates of an anti-wire tapping section for the state constitution are the Democrats, as against openly partisan opposition by the Republicans. At Washington, it was the administration leaders in Congress who tried to put the wire-tapping bill through Congress, while Republican members such as Representative Ham Fish of New York derided the bill as an attempt to authorize official snooping by New Deal bureaucrats.

The Republican defense against this wire-tapping bill at Washington was, as most readers already know, saved by the gong. The bill had passed both houses and only needed the formal acceptance of a conference report to settle a couple of minor points between the two chambers. But even so slight a delay can be fatal when the session draws to its close. And it proved fatal in this case. The conference report became snarled in the log jam of last-minute legislation and the bill died with the session.

But we may expect that the bill will be reintroduced at the next session. And since telephone men have a real interest in this legislation, it might be of some service to reproduce here the text of the bill as it finally passed the House of Representatives:

Be it enacted, etc., That the Communications Act of 1934, approved June 19, 1934 (48 Stat. 1064; U. S. C., 1934 ed., title 47, secs. 151 and the following), as amended, is hereby further amended by adding at the end thereof the following section:

"SEC. 610. Any person who uses any of the communication facilities enumerated in this act in committing, or in attempting to commit, a felony as defined by section 335 of the Criminal Code of the United States, as amended (U. S. C., title 18, sec. 541), shall upon conviction thereof, be punished for such use by a fine of not more than $10,000 or imprisonment, of not more than two years, or both."

SEC. 2. Section 605 of the Communications Act of 1934 is hereby amended by changing the period at the end thereof to a colon and adding thereafter the following: "*Provided further*, That if the head of any executive department or independent establishment of the United States reasonably believes that a violation of any criminal law of the United States, the enforcement of which is under his supervision, may have occurred, may be occurring, or may be about to occur, through a gang, confederacy, or group of two or more persons, and he makes certification accordingly, the provisions of this section shall not apply to the investigation, detection, or prevention of such violation, or of any violation of any criminal law of the United States discovered in the course of such investigation, detection, or prevention; a copy of such certificate, under the seal of the department or establishment concerned, shall be prima facie evidence of the existence of the conditions making this section inapplicable; and any evidence of a violation of any criminal law of the United States obtained under the authority of this proviso may be used against any person in aid of any prosecution for such violation."

The House committee added the following amendment to the foregoing (which was, of course, included in the House approval):

Page 2, line 23, after the word "violation," insert the following: "Any officer or agent or other person who intercepts any communication by radio, or wire without having first secured from the head of his department or establishment, authority so to do, as herein prescribed, or any officer, agent, or other person who uses or divulges the contents of any intercepted communication otherwise than as herein prescribed, shall, upon conviction thereof, be punished by a fine of not more than $10,000 or by imprisonment for a term of not more than two years, or both."

Representative Fish and other members of the lower house wanted to know just how extensive would be this proposed power for the heads of government agencies to authorize wire tapping. The following excerpt from the Congressional Record for June 15 brings out this angle:

Mr. Fish: "This is so fundamental

and so important that I should like to know how extensive it is. If this applies just to Edgar Hoover's investigating bureau, that might be one thing. This practice may be necessary in kidnaping and other cases. However, if this practice is going to be extended all over the government and the executive departments or anyone else allowed to use wire tapping for any purposes they desire, then I shall be opposed to the proposition. I should like a clear explanation of this matter. . . ."

Mr. Lea (California): "I have not the text of the bill in my hand, but I believe if the gentleman will refer to the text he will find it applies to the departments of the government charged with the responsibility of enforcement of the law, and to them only."

Mr. O'Connor (New York): "These departments all enforce their own laws. The WPA has an investigating bureau."

Mr. Fish: "Mr. Ickes has a very famous, or infamous, investigating bureau."

Mr. Lea: "They are not included. This applies only to the agencies charged with enforcement of the law. The investigating agencies are not included."

Mr. Fish: "There seems to be a little dispute as to whether this applies to investigating bureaus or just those which have power to enforce the law. May I ask the gentleman if this would apply to Mr. Ickes' investigation of Members of Congress?"

Mr. Quinn (Pennsylvania): "No; it would not apply to that at all."

Mr. Fish: "Only to police officers?"

Mr. Quinn: "Exactly; who are engaged in enforcement of the law."

Now there are a number of interested people who are not so cocksure as Representatives Lea and Quinn that the wire-tapping privilege would be strictly confined to the regular policing agencies of the Federal government. For that matter, few would object to the measure if it were certain that only the G-men, or customs' men, coast guardsmen, or other Federal policing agencies engaged in tracking down kidnapers, gangsters, smugglers, and the like, would be helped in the performance of their valuable work.

BUT WHEN you put into a Federal statute a phrase like "criminal law" and give wire-tapping authority to anybody whose duty it is to supervise the "enforcement" of that law, you open the door to a host of debatable questions.

Truth of the matter is that almost *any* Federal law is a "criminal law" in some of its provisions. Secretary Ickes, to take the example raised in the House debate, has the duty of supervising the enforcement of various laws relative to three important Federal bureaus, the Forestry Service, the General Land Office, and the Public Works Administration (he has plenty of other duties besides).

Now if you wanted to take the trouble to read through the laws relating to these three agencies, you would find that all contain penal provisions, the violation of which would be a crime punishable by heavy fines and imprisonment.

Any setting of forest fires or illegal killing of game would offend Forestry regulations. Any attempt to obtain rights to public lands by fraudulent applications would violate Homestead Acts. Falsifying applications to obtain PWA loan-grants would also offend a specific statutory provision.

The four Federal regulatory commissions all operate under laws which have penal provisions for certain violations of such laws: the Interstate Commerce Act (ICC); the Federal Communications Act (FCC); the Federal Power Act (FPC); and the Holding Company Act (SEC).

Since, therefore, it is the duty of these commissions to supervise the enforcement of these acts, the question naturally arises: Why couldn't the FPC or SEC authorize the tapping of telephone lines of various utility executives suspected of violating their respective regulatory laws? Or, to bring the problem right home to the telephone companies themselves, why couldn't the FCC even tap the lines of telephone executives (of all people) for suspected violation of the Communications Act (assuming, of course, the enactment of the wire-tapping bill as set forth in the foregoing)?

SO IT WOULD seem that if the telephone companies want to avoid the embarrassment and possible danger to their public relations that would result from indiscriminate bureaucratic snooping by every Federal Tom, Dick and Harry, who happens to suspect a violation of some law he is supposed to enforce, it would be well worth while to make a determined effort to insure the restriction of any future wire-tapping bill to the usual police authorities.

There are Edgar Hoover's G-men, of course, the Treasury's customs officials, and Coast Guard, and possibly the tax collectors. In any event, if those who are determined to authorize wire tapping are sincere in their professed desire to help only the ordinary policing agencies to get evidence, there should be no objection to naming names so there would be no doubt about the parties affected.

Indeed, there is much to be said for the view taken by the U. S. Supreme Court that wire tapping is a "dirty business" and that evidence based upon it ought to be excluded from the Federal courts as a matter of principle.

Granted that the prohibition against the use of such evidence hampers the police, granted that the police would be able to convict with more ease despicable criminals of the type entitled to no honest citizen's sympathy—there still remains the debatable proposition that it might be better for scores of criminals to go unconvicted than that the private affairs of the entire nation be exposed to unwarranted search and seizure through obviously probable abuses of official wire-tapping authority.

Naturally, it is easier for the police to get convictions if wire-tapping evidence is made legal. Using the same reasoning, it would be still easier to get convictions if the torturing of prisoners were made legal as it used to be years ago in England and other European countries.

Of course, the mere fact that evidence obtained by wire tapping may not be used in the courts does not mean that wire tapping does not go on. As a practical matter, police will tap wires no matter what the laws say—they always have, and they always will. Every executive of a telephone company operating in a community of any size at all knows that this is true and there is very little the telephone companies can do about it.

POLICE TAP telephone wires not primarily to use the evidence *per se* in the court rooms, but mostly to obtain information which will lead to more conclusive evidence. And to show how curious these government officials can be, there is a certain amount of wire tapping going on right here in Washington that has nothing to do with regular police work.

Most readers of this department will recall the incident of some months ago when a high New Deal official accused another of tapping the former's telephone wires and some days later the wires of the second high official were found to be tapped. That situation (uncovered in the course of an inspection by the telephone company) was so childish as to afford high amusement through the land.

But it isn't amusing to a telephone company which (through no wish of its own to be mixed up in such "dirty business") gets caught in the middle, so to speak. Consider the delicate situation in which a telephone company is placed when a high-up government big shot asks

"cooperation" in snooping on the affairs of another official.

From the telephone executive's point of view, therefore, the principal question involved in the proposed wire-tapping statute is whether the doubtful advantage of placing the responsibility for the wire tapping directly on the official who ordered it (thereby getting the telephone company "out from under" to some extent) is more than offset by the probable result of increased use of wire tapping by government heads.

IT MUST be admitted that notwithstanding the sop to the critics of wire tapping in the form of stiff fines and imprisonment for abuse of the wire-tapping authority, the safeguards in the proposed law are not very satisfactory.

What practical difference does it make how much of a fine and imprisonment the statute slaps on illegal wire tapping? Every experienced telephone man knows that it is exceedingly difficult to catch a wire tapper red-handed at his work; and even in those rare cases where the tappers have been caught, it has been next to impossible to secure a conviction. In the case of a government employe, it *would* be just about impossible to get a conviction.

And would those stern proposals against unauthorized use of wire tapping prevent naturally-snooping government men from "blind angling," as they call the practice of tapping in at random like a neighborhood busybody? There is no reason to believe that government men would be more restrained and high-minded in their exercise of official authority than the police of the average big city, who frequently tap telephone lines on mere suspicion and if nothing turns up, nobody ever knows about it.

AND THIS brings up the "certification" joker in the proposed bill. Notice that the bill does not require the certification to be made *before* the tapping. Nor does the bill require the department head to *file* the certification with any independent recorder of documents. There is nothing, therefore, to prevent a department head from telling his men to go ahead and tap lines anywhere they please. If in the process desired evidence turns up, the official can then make out his "certificate." And what's more, he can keep it in his own office until the time comes for qualifying the evidence in a court of law.

This loose practice is something like police searching and seizing personal effects and *thereafter* obtaining a search warrant so as to legalize any evidence that happened to turn up. Of course, making police officials file wire-tapping "certificates" (before wires are tapped) as public documents would be the same as putting suspected criminals on notice; but certainly there could be found some way of recording such documents *ex parte* besides allowing full control over them to remain with the official who makes them out.

This is not to suggest that unofficial wire tapping is rampant in Washington. More often than not the rumors about it spring from neurotic officials who are, to use the trade slang "tap goofy." They are positive that every buzz or click on their line means that somebody is tapping their wires. In nearly all instances they are in error.

WHAT IS MORE important from the Washington angle than wire tapping itself is the prevention against it. Your correspondent made some original inquiries about this last week after reading in the June 18 issue of The New Yorker about the diabolically clever devices used by the modern skilled wire tapper (such as the powerful inductive coil which attracts conversation from a nearby wire without even touching it; the "dial detector" for recording telephone numbers from mere dial clicks; and the tiny "mike" or "bug" concealed inside of a previously rigged telephone which transmits conversation occurring in a room even when the telephone is not in use).

The local telephone company, following the usual Bell practice, does all it can to protect its subscribers from the annoyance of surreptitious "visitors" on their lines. Thus, if any subscriber, no matter who he may be, complains of suspected wire tapping, and there is any reason at all to indicate that the complaint may have some basis, the company will make proper tests and inspections.

If foreign objects are found on the subscriber's line, the company removes them. It doesn't matter who put them there, off they go. If the company's inspector finds no actual intercepting equipment in use, but discovers any reason to believe that such equipment has been employed, it will make further inspections of the line at subsequent intervals. But this is still not enough for highly important government lines. And it has been found necessary for certain Federal agencies to take additional steps to safeguard the secrecy of government communications via telephone.

Take the White House, for example. The offices of President Roosevelt and every one of his secretaries and subsecretaries are carefully inspected every so often by the U. S. Secret Service men. It's hard to imagine anybody getting into the White House at all without proper reason, let alone planting a "bug" in the President's telephone or tapping in on the White House cable box. Just the same, the rooms, the walls, the halls and the cables are all gone over every so often to insure that there has been no monkey business.

This rigorous scrutiny by the U. S. Secret Service is carried out as far as the street, where the responsibility must be taken over by the telephone company. For mechanical reasons, the President's line is as safe, once it reaches the street cables, as a penny thrown in the mid-Atlantic. (Imagine a wire tapper digging a hole in Pennsylvania Avenue without attracting attention, even if he knew what to do after he reached the conduit!)

For technical reasons which only telephone people can fully appreciate, the possibility of a foreign spy (or one of domestic variety) tapping in at the central exchange office in Washington is too remote to worry

(*Please turn to page* 34)

COMING CONVENTIONS

California Independent Telephone Association, Miramar Hotel, Santa Monica, July 6 and 7.

Michigan Independent Telephone Association, Hotel Olds, Lansing, July 27 and 28.

The Illinois Telephone Association, Hotel Pere Marquette, Peoria, September 21, 22 and 23.

United States Independent Telephone Association, Hotel Stevens, Chicago, October 18, 19, 20 and 21.

Independent Pioneer Telephone Association of the United States, Hotel Stevens, Chicago, Thursday, October 20.

South Dakota Telephone Association, Mitchell, October 5 and 6.

Virginia Independent Telephone Association, Hotel John Marshall, Richmond, November 3 and 4.

REA Favored in Minnesota Court Case

DISTRICT COURT RULED the Minnesota Railroad & Warehouse Commission has no authority, under state laws, to require REA cooperative to pay a telephone company any sum to be used in metallicizing its grounded lines rendered useless by inductive interference from paralleling power lines. Commission's order and decision in the complaint of Lismore Cooperative Telephone Co. against Nobles Cooperative Electric (REA Project No. 66) vacated and set aside

THE MINNESOTA Railroad & Warehouse Commission does not have jurisdiction, under Chapter 152 of Laws of Minnesota for the year 1925, to fix and determine any sum as compensation to be paid by the Nobles Cooperative Electric to the Lismore Cooperative Telephone Co., for the purpose of defraying in whole or in part the expense necessarily incurred or to be incurred by the telephone company in metallicizing its single-wire grounded lines or otherwise to so condition them as to give effective telephone service after the construction and operation of the electric power lines of the Nobles Cooperative.

Thus ruled District Court Judge A. B. Gislasen of the 13th Judicial district of Minnesota, June 20, in deciding an appeal by the Nobles Cooperative Electric (project No. 66 of the REA), Worthington, from the December 21, 1937, order and decision of the Minnesota commission in the complaint of the Lismore Cooperative Telephone Co. against the REA cooperative, and upon the court's certiorari to the commission to review the same order and decision. The commission's order and decision was vacated and set aside. The court's judgment was stayed for 40 days.

This controversy was originally initiated upon the verified complaint of the telephone company filed with the Minnesota Railroad & Warehouse Commission, purporting to proceed pursuant to the provisions of Chapter 152 of the Laws of Minnesota for the year 1925, which said law is also referred to as Section 4718-1 and 2, Mason's Minnesota Statutes for the year 1927.

In its complaint, the telephone company represented that it is a cooperative Minnesota corporation having its principal office at Lismore in Nobles County, Minn., and that it maintains certain rural lines radiating therefrom, which have been operated for many years; that in certain cases where the power lines would parallel or would be in close proximity to the existing lines of the telephone company, they would seriously interfere with the operation of the telephone company, which is equipped with single-wire grounded lines.

Telephone Company Set Forth Causes for Damage

This interference, it was stated, would render the telephone company's lines less effective and to some extent non-commercial; that as a result of this interference, the telephone company will have to expend substantial sums of money to so change its construction as to render its lines serviceable in the future; that the proposed lines of the power company will parallel the lines of the telephone company approximately 15 miles.

The telephone company asked that the commission determine what damage it is entitled to and, in effect, petitioned that the commission order the payment by the power company to the telephone company of such sum as may be determined by the commission.

The commission made its findings and decision dated and filed December 21, 1937 (TELEPHONY of January 1, 1938). In effect it ordered and directed that the power company pay to the telephone company the reasonable value of the material necessary to metallicize the telephone lines to eliminate inductive interference, which sum was found by the commission's decision to be $610.50.

The decision further ordered that the power company pay the money before energizing its lines in the territory involved. The telephone company was ordered to install the necessary materials in order to eliminate inductive interference which would be caused by the construction and operation of the power lines.

In his decision Judge Gislasen stated that from the undisputed evidence, stipulations, admission made upon the hearings and in the briefs, as well as upon oral argument, "it fairly appears that the power company is using modern up-to-date equipment approved by the best engineering methods, and has not been guilty of negligence in respect to the type of material used and the method of construction employed; that the power company has not failed to utilize all reasonable means to construct its lines so as to interfere as little as possible with the lines of the telephone company."

"It also appears," the decision continues, "that any type of construction necessarily employed for the carrying of high voltage electrical currents required for rural electrification would cause electrical disturbance to the lines of the telephone company so long as it maintains single-wire grounded-line construction; that it will ultimately become necessary for the telephone company to metallicize its lines so as to supersede the type of construction that has been used for many years.

"That in the construction of a new telephone line in any territory that is well settled and where existing electrical power lines are in operation, telephone companies necessarily construct their lines at their own expense so as to avoid or minimize the interference which results from the presence of power line construction paralleling or in close proximity to single-wire grounded telephone lines."

In a memorandum which is made a part of the decision Judge Gislasen amplified his decision as follows:

"The respondent is a cooperative

association about to enter the utility field and as such is under the jurisdiction of the Minnesota Railroad & Warehouse Commission the same as telephone companies and other public utilities. 195-336.

Right of Prior Occupancy of Highways

It is seriously urged that the telephone company in this case, having maintained and operated its telephone line for many years in its present location, and being a prior occupant of the highway, has the superior right and is entitled to damages for electrical interference caused by the high powered line of the respondent, a subsequent occupant of the highway.

It seems to be well settled that telephone companies though first in the highway cannot claim any superior rights over street railways for the reason that highways are primarily intended to be used for travel, and street railways — being primarily used for travel while telephones are not, although the use of telephones lessens travel upon the highways— are, therefore, given the same right in the highways as telephone companies even though the telephone companies are there first in point of time.

Where no such primary use of the highways is involved the authorities are somewhat in conflict. It is conceded in the present case, as I understand it, that there is no claim made that the respondent is guilty of any negligence, trespass or malice; and it is not claimed that there is any physical or structural interference, and it is admitted that there is no unreasonable or unnecessary interference by reason of construction, and that the only interference is that of unavoidable electromagnetic induction. There is no claim of conductive interference.

Both parties are operating under a legislative grant of power. The weight of authorities seems to hold that the rule—imposing liability for damages naturally arising out of an extraordinary use of property—does not apply to cases of inductive interference, where both parties have applied their properties to extraordinary use as the parties have done in the present case, and this rule is applied irrespective of priority of occupancy where the interference is reasonably unavoidable.

In Phillippay v. Pac. Power & Light Co., 23 A.L.R. 1251, it is stated: 'In this case the use of electricity is common to both parties, and both are acting under legislative sanction. In such cases it seems to be the consensus of opinion, both in England and in this country, that where one is acting under legislative authority, and within the right thus given, and reasonably within the exercise thereof, using due care and caution regarding the rights of his neighbor, any inconvenience or incidental damage that may arise, in the absence of any negligence, from the reasonable use of his own property will be regarded as within the rule of damnum absque injuria.' See 23 A.L.R. 1257; 33 A.L.R. 373; 56 A.L.R. 414; 220 Pac. 425; 260 Pac. 1101; 70 N.E. 866; 20 C.J. 313; 12 M.L.R. 414; 89 M. 495; 176 N.W. 143; 29 S.W. 329.

Where there is physical or structural interference, the prior occupant or licensee will, of course, be protected. Such was the situation in 89 M. 495. There the defendant's wires came in actual contact with plaintiff's poles if not its wires. I do not think that case goes any farther than to hold that the prior occupant will be protected where there is actual physical interference. Nothing is said about inductive interference, so the question here presented is one of first impression in this state.

This rule of non-liability may be changed or modified by statute and applies only where there is no statute creating a liability. In Minnesota there is a statute, Chapter 152, Laws of 1925, entitled 'An Act to empower the Railroad & Warehouse Commission to regulate the construction, operation and maintenance of telephone lines and the lines of other public utilities where the same parallel or cross each other, or railroad rights of way.'

This law provides that 'the Railroad and Warehouse Commission shall . . . determine and promulgate reasonable regulations covering the maintenance and operation and also the nature, location and character of the construction to be used . . . where electric wires of any kind cross, or more or less parallel the lines of . . . and other public utility, and, to this end, shall formulate and from time to time issue general regulations covering such class of construction, maintenance, and operation of such . . . parallel . . . and the commission upon the complaint of any person . . . claiming to be injuriously affected . . . shall, after a hearing, make such order and prescribe such terms and conditions for the construction, maintenance and operation of the lines in question as may be just and reasonable.'

The respondent contends that chapter 152 constitutes an unlawful delegation of judicial power to the commission if it be construed as authorizing the commission to assess damages against the later occupant of the highway. The supreme court of this state has never had occasion to construe this law.

Investing the commission with the power to assess damages is clearly a grant of quasi judicial power. Most if not all other duties of the commission are administrative and legislative in character. The work of the commission in directing and regulating the construction and repair of the telephone line in question is largely administrative, and the fixing of the damages would be only quasi judicial in character.

While such proceedings would not give to the courts the right of a trial de novo, they are subject to review by the courts. The courts would have the power to determine the reasonableness or unreasonableness of the assessment made; that is, to confirm or annul the assessment.

Greater quasi judicial powers have been given to other boards, such as industrial commissions, assessors, tax commissions, and commissioners in eminent domain proceedings. Such a power, where the courts have the right to review, in my opinion, would not offend the constitutional provision. I believe that 177 M. 146 is determinative of this question. See also 141 M. 124; 139 M. 32; 125 M. 194; 39 M. 65; 142 N.W. 471; 19 M.L.R. p. 292.

But does Chapter 152 Laws of 1925 confer upon the Railroad and Warehouse Commission the right to assess damages, assuming that such power may be conferred?

Analysis of Minnesota Law Regarding Damages

In considering this question we assume at the outset that in the absence of a statute there is no liability, in the absence of negligence and unnecessary interference, for inductive interference. It is very patent, both from the title and body of this law that the commission shall regulate the physical and structural construction, operation and maintenance of both telephone and electrical power lines where they cross or parallel each other.

The law says it shall 'determine and promulgate reasonable regulations covering maintenance and operation and also the nature, location and character of the construction to be used.' Its powers in that respect relate solely to the future. It also provides that the commission shall 'make such order and prescribe such terms and conditions for the construction, maintenance and operation

of the lines in question as may be just and reasonable.'

If any authority is given to the commission to assess damages, it must be spelled out of the provision last quoted. But this section of the statute seems to deal with the physical nature and equipment, and the control of construction, maintenance, location and operation of the lines.

Section 2 of the law is not helpful to the telephone company. This refers to the enforcement of the law and gives to the commission the power to 'cause the removal or reconstruction of such telephone . . . power or other wires of any kind crossing or paralleling such other lines and not in accordance with the orders, rules and regulations issued by the commission.'

The power given in section 2 is limited to causing the removal or reconstruction of the lines. That is the only power given by this section to the commission to enforce the provisions of section one.

The cardinal object of this statute appears to be to give to the commission certain regulatory powers over telephone lines and other public utilities, with respect to physical and structural conflicts, and does not seem to contemplate adjustment of damages for electrical interference as distinguished from physical and structural interference; and to that end the commission is required to determine and promulgate reasonable regulations covering the maintenance, operation and also the nature, location and character of the construction to be used.

Pursuant to this requirement the commission has adopted certain rules and regulations with respect to its supervision, but it does not appear that it has ever adopted any rules or regulations with respect to the matter of damages. None has been called to the court's attention.

It cannot be seriously claimed that this law expressly confers any authority upon the commission to assess any damages against one utility in favor of another. The commission is an administrative board having certain legislative powers. If the commission has any power to assess damages, it must derive its authority from this statute, which does not expressly give any such power.

I can find no provision in this law which gives to the commission the power to determine and adjudicate the matter of damages arising out of the construction of the electric line. In my opinion that is a judicial power which has not been conferred upon the commission.

The law in question confers upon the commission certain specific powers. It being primarily an administrative body, its authority should clearly appear, before it is clothed with quasi judicial powers. Without the statute, the power does not exist. It should not be read into the statute by implication. Powers specifically conferred cannot be extended by implication. 59 C.J. 973.

In the final analysis, as far as equity is concerned, this becomes a question as to whether or not the farmers interested in the electric company, who receive no benefits from the improvements to be installed by the telephone company, or the farmers owning the telephone company should pay for modernizing the telephone line.

Most telephone lines now being constructed are fully metallicized. That is considered good business. Under the circumstances the telephone company should pay for the improvement, and there seems to be no good reason for reading into the law a power which is not expressly conferred."

The Operators' Corner

By MRS. MAYME WORKMAN
Traffic Supervisor, The Illinois Telephone Association, Springfield, Ill.

CONDITIONS under which it is proper to ring a nearby telephone. Traffic series No. 333

RINGING nearby telephones, except in case of an emergency, is fast becoming an obsolete practice. Many telephone subscribers object to acting as messenger for people who do not have a telephone and so it is not uncommon to receive a request from a subscriber not to ring his telephone when a call is received for someone who lives nearby.

This week someone has submitted the question: "If a subscriber asks us to ring a nearby and call someone who has no telephone, what should the operator do?" The answer is: "If you have been instructed not to ring nearby telephones, say, 'I am sorry, we do not ring nearby telephones'."

In some cases a long distance operator at a distant point may request an operator to ring a nearby telephone. It is assumed that this request is made in compliance with a request received from the calling party or in connection with the completion of an emergency call.

In this case, when the called station is reached, the operator at the originating office will announce the call, saying, for example: "This is the Taylorville operator. Mr. Jones in Taylorville is trying to reach Mr. Hill at 218 Main Street and asks whether it would be possible for you to send for him?" This phrase implies that the request to ring the called party's telephone for the purpose of calling someone nearby originated with the calling party and not with the operator.

The average person will not object to calling a friend or neighbor to the telephone in case of emergency or for a very important call but they usually do object to having people make a practice of using their telephone or to expect them to act as a messenger in calling them to the telephone. Some people are very inconsiderate in this respect and do not hesitate to give out their neighbor's telephone number to their friends, requesting them to call that number when they wish to talk to them.

Generally speaking, telephone companies do not encourage the practice of ringing nearby telephones as this is unfair to the subscriber who is paying for the service. It also has a tendency to discourage the nonsubscriber in having a telephone installed.

As under all other traffic conditions, there will always be times when the operator will be called upon to use her judgment in the matter of ringing a nearby telephone.

Questions from Illinois Operators

1. Which is correct: "Ring again," or "I'll ring them again?"
2. How long may an operator hold a toll line for a call?
3. If a subscriber asks us to ring a nearby and call someone to that telephone who has no telephone, what should the operator do?
4. Would more attempts to complete calls being held be helpful in completing delayed calls?
5. Is it necessary to request the calling party to hold the line on a long distance call?

The answers to these traffic questions are given on page 25.

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Here and There in the Field

Company Buys Properties, Starts Improvements

The Magnolia Telephone Co. of Jackson, Miss., on June 1 acquired the properties in the state operated by the Mississippi State Utilities Co. There are 18 exchanges and 80 miles of toll pole lines in the new system, which plans to spend about $35,000 to bring the property up to standard, including copper metallic toll lines.

The new company has assets of $57,544.49, including $5,500 in paid in corporate surplus. All of its capital stock is owned locally.

The Magnolia company is controlled by Lon J. Darley, who has had about 20 years' telephone experience in Texas, Oklahoma, Arkansas, Alabama and Mississippi. Mr. Darley is vice-president and treasurer in full charge of operations, and J. Ed Franklin, a prominent attorney of Jackson, is president.

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Watonga, Okla., District Meeting Attended by 63

Sixy-three telephone people (32 women and 31 men) attended the first of the 1938 series of district meetings of the Oklahoma Telephone Association held at Watonga, Friday, June 24. The meeting was under the auspices of the Western Light & Telephone Co., with Endsley Jones of Kingfisher, superintendent of the company, presiding and H. W. Hubenthal, Oklahoma Telephone Association, acting as secretary.

During the morning session J. W. Walton, vice-president of the Oklahoma Telephone Co., Broken Arrow, and a member of the board of directors of the United States Independent Telephone Association, reported on the class A and B conference of the national association.

Mr. Walton praised the work of the national and Oklahoma associations, urged telephone companies to take a non-partisan interest to prevent harmful legislation in Congress and in the state legislature, and to subscribe for magazines devoted to the telephone industry so that they can keep well informed on their business.

Speaking on "Commercial Practices," Miss Fay Tschopp, chief operator of the Western Light & Telephone Co., at Kingfisher, reported that her company had maintained collections up to 90 per cent or more through constant efforts and careful watching.

Much depends on making out toll tickets with careful detail and on having them come in daily, Miss Edna Karrenbrock, toll chief of the Western Light & Telephone Co., at Kingfisher, declared in her address on "Toll Billing."

C. E. Devin, Apache, president of the Oklahoma Telephone Association, called attention to some of the advantages of belonging to the Oklahoma and national associations.

In his address on "Standard Methods of Handling Tributary Traffic," R. P. Suits, district traffic chief of the Southwestern Bell Telephone Co., Enid, compared the former slow methods of handling telephone calls with modern methods of obtaining speedy and much more dependable local and toll service.

Mrs. Lillie Wheelock, Watonga, chief operator of the Western Light & Telephone Co., discussed "A Chief Operator's Duties and Problems" in an address, which emphasized the importance to a company of a chief operator who can select the right kind of employes, gain their confidence and develop in them a desire to do their best.

At a noonday luncheon L. J. Bullis, Oklahoma City division commercial superintendent of the Southwestern Bell Telephone Co., acted as toastmaster. An address of welcome was given by Arnold Goerke, mayor of Watonga.

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Independents Asked to Cooperate in Fair Feature

As a feature of its exhibits at the New York and San Francisco expositions, to be held next year, the American Telephone & Telegraph Co. has announced that there will be an offering of free toll calls to visitors, along a plan similar to that which proved so successful at Chicago and Dallas fairs.

Complimentary long distance calls which were offered to Chicago fair visitors were restricted to those whose destination was served by a Bell exchange. It is proposed for the 1939 fairs that no restrictions be placed on these free calls and that Independent companies waive the right to compensation on calls of this character.

To that end, the directors of the United States Independent Telephone Association unanimously adopted a resolution approving the suggestion and urging all Independent companies to cooperate with the A. T. & T. Co. in this entertaining and instructive advertising of telephone service.

▼ ▼

Tennessee Group Meeting Held at McKenzie

The Tennessee Independent Telephone Association held an enthusiastic district meeting at McKenzie in West Tennessee on the afternoon and evening of June 10. Secretary-Treasurer B. H. Piepmeier, of Cookeville, has been quite successful in handling these group meetings to create interest in the association and to organize Independent companies in defending their rights in connection with REA programs and other important matters.

West Tennessee has about 60 small Independent telephone companies. About one-half of these companies were represented at the McKenzie meeting, making a total of about 50 men and 15 women present.

At the group meeting of the men they were informed of the activities of the association to date and what it means to every small Independent company. J. N. Cox, chairman of the board of directors of the Tennessee

This group of telephone people in West Tennessee gathered at McKenzie June 10 to attend the group meeting of the Tennessee Independent Telephone Association. B. H. Piepmeier, secretary-treasurer, may be seen on extreme left, front row.

The long and the short of telephone operating! Miss Leitha Harris, traveling chief operator of the Southern Continental Telephone Co. at McMinnville, Tenn., weighs 100 pounds while Miss Georgia Turner, night operator at Martin, Tenn., for the past 20 years, tips the scales at 200 pounds. Miss Harris was traffic instructor at recent Tennessee Independent association group conference in McKenzie.

association, explained what program should be followed in contemplated REA work.

The meeting was then thrown open for a round-table discussion on plant problems led by I. B. Washburn, plant superintendent of the Southern Continental Telephone Co., Cookeville.

The 15 women attending the conference had a meeting of their own where traffic problems were freely discussed under the leadership of Miss Leitha Harris, traveling chief operator of the Southern Continental Telephone Co., McMinnville.

Following the round-table conferences several pictures were taken, two of which are reproduced on these pages, and the Bell repeater station office at McKenzie was inspected. At 7:00 p. m. an old-fashion fish supper was served at the Lynn Hotel.

All who attended were enthusiastic over the day's work and agreed to reassemble again in the very near future and to attend the state convention scheduled at Nashville in November.

Machine Turns Down Telephone Between Words

The newest telephone robot, whose job is to turn down the circuits automatically during the tiny silent intervals between a speaker's words, is described by C. C. Taylor of the Bell Telephone Laboratories in the Bell System Technical Journal.

Everyone knows how difficult it is to talk in noisy places, chiefly because the noise drowns out the sounds of speech. This deafening effect of noise often lasts some time after the noise is over, like the experience of persons who find themselves temporarily deafened after visits to a boiler factory or rides in one of the old-fashioned noisy airplanes.

Even during the tiny pauses between words of a speaker's sentence the same thing applies. If everything is quiet during these pauses, the listener's ear keeps its full sensitivity but if there is much noise during the pauses the ear is slightly deafened. The next speech sound, when it comes, is less easily heard.

Over the telephone, noises that accidentally get into the transmitter or electrical noises which originate somewhere in the system may act in this same way. That is why Mr. Taylor's new robot has been devised. By a vacuum-tube apparatus utilizing special properties of the electric one-way valves or rectifiers made of copper oxide, the device automatically reduces by about 99 per cent any noise passing over the wires during the tiny pauses between speech sounds. When the next speech sound comes along the robot needs only a few millionths of a second to put everything back to normal, so that the desired sounds come through with full intensity.

Recalls Lightning Warning of 1877 Telephone

"Now, sonny," said the man, "in case of a thunderstorm, you get away from this room. Lightning might strike that thing."

The messenger boy nodded and glanced awesomely at the huge telephone standing against the wall of the office of the city clerk of Rochester, N. Y. The telephone was about the size of a grandfather's clock.

That incident happened 61 years ago last February 15 and Charles Beatty, the erstwhile messenger boy, celebrated the anniversary—at his desk as vice-president and treasurer of Rochester Telephone Corp., the successor to the firm which installed the fearsome device in the Rochester city hall in 1877.

The telephone in question was the first instrument used by the city in its business contacts and was operated by Edward Angevine, then city clerk. Little dreaming that he himself would go into the telephone business in 1900, Beatty—then a lad in his 'teens—was employed to run errands.

The 76-year-old telephone executive is the only remaining Rochesterian who attended installation of the city government's first telephone.

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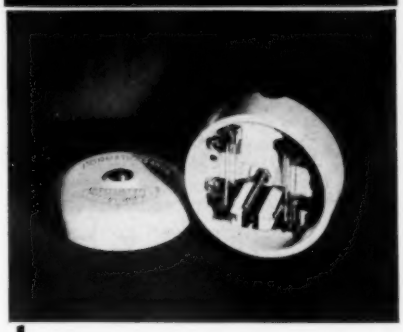

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Chicago

Personals About Telephone Men

FRANK L. McKINNEY, secretary-treasurer of Ohio Independent Telephone Association, left Columbus June 24 for New York, where on the following day he sailed on the Cunard master ship Georgic for a trip through England and Scandinavia.

He expects to land at London, proceeding thence to New Castle, crossing the North Sea to Bergen, Norway, and visiting also Stockholm, Gathenburg and Copenhagen. He will return home on the Bremen July 29.

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S. B. GREEN, for the past two years district manager for the Wabash Telephone Co., at Paris, Ill., has been appointed general manager of the Illinois Valley Telephone Co., with headquarters at Streator, Ill. He assumed his new responsibilities June 1.

Mr. Green has been identified with the telephone industry for many years. Prior to 1936 he had served as district manager for the Georgia Continental Telephone Co., at Dawson, Ga., for several years.

Other connections which Mr. Green has had in the telephone field include those of manager of the Toledo (Iowa) Telephone Co., general manager of the Tri-City Telephone Co., Clinton, Iowa, and an executive position with the Southern Continental Telephone Co., of Cookeville, Tenn.

For a short time prior to his appointment, in April, 1926, as general manager of the Tri-City company, Mr. Green traveled in the state of Iowa, representing the Midwest Directory Publishing Co., of Blue Mound, Kans.

In addition to his business connections, Mr. Green was only recently selected as director of the Paris Rotary Club and was sergeant at arms-elect. He is vice-president of the Paris Chamber of Commerce and junior warden of St. Andrew's Episcopal church. He has been active in all Paris civic affairs.

Mr. and Mrs. Green and their daughter have taken up residence in Streator.

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ALFRED STANLEY PETERS, inventory and costs engineer of the Mountain States Telephone & Telegraph Co., Denver, Colo., retired recently, after devoting almost 46 consecutive years to telephone work.

Born in St. Joseph, Mich., Mr. Peters moved to Chicago and attended the Northwestern University Preparatory School from 1890-91.

Mr. Peters' first telephone connection was with the Western Electric Co. in Chicago, where he started in the switchboard department, September 5, 1892. In 1894 he was sent to Salt Lake City to help install central office equipment. March 1, 1895, he began to work for the Rocky Mountain Bell Telephone Co. in that city. He continued his education at the University of Utah from 1897 to 1899 while working for the telephone company part time.

Appointed chief engineer of the Rocky Mountain company in July, 1904, Mr. Peters retained this position until the Mountain States Telephone & Telegraph Co. was formed, in 1911. After an assignment of special engineering work, he was appointed division engineer of the company for Utah and Idaho, in June, 1913.

Transferred to Denver, in January, 1919, in July of that year he was made valuation engineer. Although the title was later changed to inventory and costs engineer, Mr. Peters held this position from that time until his retirement.

Mr. Peters was guest of honor at a recent banquet of the Bell Forum in Denver, and also at a luncheon given by President F. H. Reid of the Mountain States company.

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RICHARD WHITCOMB, western division manager of the New England Telephone & Telegraph Co., Springfield, Mass., has been appointed chairman of a supervisory board to investigate economy possibilities in the city government of Boston upon invitation of Mayor Tobin, who is also an ex-telephone man.

Mr. Whitcomb was born in Topeka, Kans., in 1894, and was graduated from Washburn College in that state in 1915. He served in the world war with the 32nd infantry, and is now a major in the reserve.

He entered the employ of the Bell System in 1924; served with the A. T. & T. Co. in New York from 1927 to 1929, and then became general sales manager of the New England company. He was transferred to Springfield in 1933 and is president of the Western New England Telephone Co., an Independent organization.

In 1932 and 1933, Mr. Whitcomb was executive manager of the Boston emergency relief campaign and in one of these raised $3,000,000 in two weeks at an expense of 0.75 per cent.

Financial Operating News and Data

Report of General Telephone Corp for Year 1937

The General Telephone Corp., New York, reported for the year 1937 a gross income of $1,355,480, operating expenses and taxes totalled $185,136, net income was $1,170,345, an increase of $151,258 over 1936. After dividends of $220,539 on the $3 convertible preferred stock, net income available for dividends on common stock amounted to $949,806. Common stock dividends of $1.35 a share amounted to $941,624. The

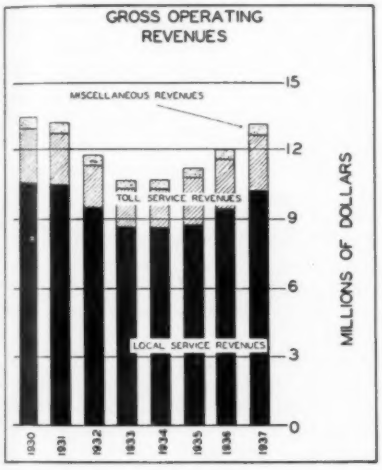

Chart showing gross operating revenues of the General Telephone Corp. for the years 1930-1937.

company's assets as of December 31, 1937, were $28,509,967.

Operating subsidiaries of the General Telephone Corp. experienced a net increase of 22,600 (or 6.74 per cent) in telephones over 1936. This compared with an increase of 6.35 per cent in 1936, 3.95 in 1935 and 1.64 in 1934. In addition, control of properties having 5,225 telephones in service was acquired last year. Thus at the end of 1937 the subsidiaries operated 362,541 company-owned telephones and 10,921 service stations. This is within 5.05 per cent of the maximum number served. The telephones served by the Associated Telephone Co., Ltd., Santa Monica, Calif., at the end of 1937 were 13.37 per cent above its previous high.

Including the subsidiaries of the Indiana Central Telephone Co. (still under reorganization) which are operated as part of the General system but whose financial statements are not consolidated therewith, the entire system had 443,735 owned telephones in service and 17,408 service stations.

Consolidated gross revenues of the General Telephone Corp. and subsidiary companies (excluding General Telephone Allied Corp.) for 1937 were $13,114,890, an increase of 9.63 per cent over the previous year. Taxes chargeable to operations were $1,559,312, an increase of 28.6 per cent. Only $3,260 of the 1937 taxes were on undistributed profits. Net operating income, $3,166,285, represented a decline of 2.05 per cent as compared with 1936. The consolidated net income, after all charges excepting dividends on preferred stock of the General Telephone Corp. amounted to $1,331,689, an increase of $31,779 over the year 1936.

The assets of the General Telephone Corp. and subsidiary companies (excluding the General Telephone Allied Corp.) total $83,186,158. Of this total $70,745,171 are invested in telephone plant, and $1,663,738 in common and preferred stock in the General Telephone Allied Corp. "Other investments" have a book value of $1,078,489. This item includes $632,407 of investments in and receipts from the Indiana Central Telephone Co., in process of reorganization under section 77B of the Bankruptcy Act. Current assets, including $2,779,998 in cash, have a book value of $6,614,695.

The major items in the liabilities account are: Preferred stock, $3,675,650; common stock, $14,013,017; surplus, $10,377,826; preferred stocks of subsidiary companies, $8,574,355; funded debt, $31,522,500; reserve for depreciation, $11,376,906.

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Investment Company Shows 1937 Gain

The annual report of the Telephone Bond & Share Company, of Kansas City, Mo., for 1937, shows that its subsidiary operating companies had a total of 206,879 telephones in service at the close of last year, a gain of 4,643 over the preceding year. This compares with a gain of 7,597 stations in 1936.

The company's earnings were $804,174; operating expenses and taxes amounted to $123,819 and interest deductions, $541,811. The net income was $123,544, as compared with a net income of $114,385 in 1936. After the payment of dividends, there was a balance in the earned surplus account, as of December 31 last, of $1,001,614.

Reporting to the stockholders, Presi-

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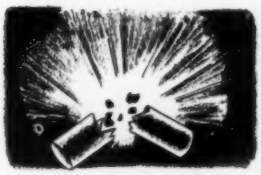

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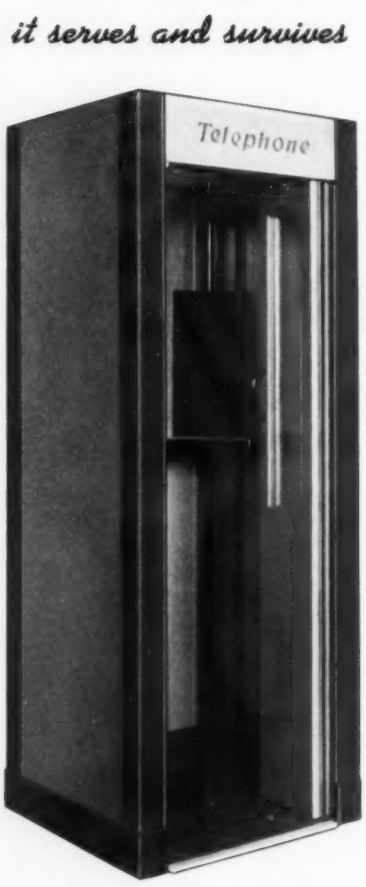

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National Distributors and Sales Agents

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dent V. E. Chaney said that a number of operating companies were required to make substantial cash outlays in 1937 to rehabilitate their plants as a result of damage caused by the Ohio Valley flood and sleetstorms in Missouri, Illinois and Texas. Some of these companies have not yet regained all the revenue lost as a result of the property damage sustained, he added.

The president also reports that the combined taxes of this group of operating companies showed an increase of $52,000 over 1936 and were approximately $325,000 more than in 1931. During 1937 several of the companies found it necessary to increase wages.

The operating companies of the Telephone Bond & Share Company have combined assets totalling $38,501,661, $33,659,691 of which is represented by telephone plant and equipment.

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Annual Report of the Jamestown (N. Y.) Telephone Corp.

The Jamestown Telephone Corp., of Jamestown, N. Y., reports an increase of 10.25 per cent in operating expenses for 1937 in contrast to a gain of 4.66 per cent in operating revenues. Reporting to the stockholders on the past year's operations, President John H. Wright states:

"For the past few years expenses, including taxes, have continued to rise out of proportion with the revenues. Should this trend continue, a revision of rates will be necessary in order to protect the principal and insure a reasonable return to the investors."

Operating revenues for 1937 amounted to $485,543, while operating expenses were $301,268. Of that amount $167,997 went for payrolls. Included in operating revenues is an item of $107,057 for toll service revenue, subject to possible revision on account of pending litigation. Income available for fixed charges was $135,668, a decrease of $5,511 from 1936.

Income available for first cumulative preferred stock dividends was 2.8 times requirements. The balance available for dividends on class B participating stock and common stock amounted to $40,586, as compared with $41,292 in 1936. Dividends on these stocks have averaged 4.4 per cent for the past 10 years.

Last year the company made gross additions of $171,821 to plant and gross retirements of $116,351. In addition, $87,722 of property no longer used for telephone purposes was transferred to the miscellaneous physical property account. The book value of telephone plant as of December 31, 1937, was $2,340,552, while the total assets were $2,809,389.

On December 31 last the Jamestown company had 9,290 telephones in service, a net increase of 521 stations as compared with an increase of 312 in 1936. The total was still 14.7 per cent less than the peak number of 10,895 telephones reached in 1929.

The company operates seven central offices and 69 private branch exchanges. There are 30,397 miles of wire in its plant, 14,871 of them underground. Exchange messages averaged 49,794 daily, while outward toll messages amounted to 331,850 for the year.

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Mankato (Minn.) Co. Passes Previous Peak

The Mankato Citizens Telephone Co., of Mankato, Minn., reports gross revenues of $188,942 for 1937, an increase of $10,093 over the preceding year. With a net gain of 262 telephones, the company had in service December 31, 1937, a total of 6,530 stations. This exceeds by 359 the previous peak development reached in 1930. In addition to the owned stations, the company serves 518 farmer-owned stations, a decrease of 99 from 1936.

Included in the gross revenues were toll revenues of $93,457. The year's volume of toll traffic (212,831 calls) represented an increase of 7 per cent over 1936.

Operating expenses for 1937 totalled $147,058, an increase of $14,060 per cent. This is due in part to wage increases and to the cost of relocating poles to make way for highway improvements. Increases in taxes account for $8,454 of the increases in operating costs, the total tax for 1937 having amounted to $26,109. It represents $5.80 per subscriber as compared to $2 in 1926, when the present rates were placed in effect. Net earnings were $45,852, as compared with $41,884 in 1936.

The company has invested in plant a total of $898,132, or $128 per telephone station. It has been found necessary to supplement its switchboard and cable facilities during the ensuing year to keep pace with the increasing demands for service.

The company operates five exchanges serving six communities including the rural districts adjacent thereto, namely Mankato, North Mankato, Mapleton, Good Thunder, Madison Lake and Eagle Lake, all within the county of Blue Earth, excepting North Mankato which is located in Nicollet county.

An average of 5½ calls per day are originated by subscribers of the Mankato company, or an average of 40,000 for all the exchanges. There are more than 425 miles of pole line in the system and more than 12,000 miles of wire. The company owns 125 miles of toll lines connecting its various exchanges.

The wages of the 45 employes approximate about $70,000 annually.

The balance sheet of the Mankato Citizens Telephone Co., now in its 40th year, shows assets totalling $942,208. Its major liabilities are: Common and preferred stock, first mortgage bonds, $175,000; depreciation reserve, $293,522; and surplus, $52,235.

H. A. Patterson is president of the company; W. D. Willard, secretary-treasurer, and P. M. Ferguson, manager.

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Associated T. & T. Reports Increase in 1937

The Associated Telephone & Telegraph Company in its annual report for 1937 shows gross earnings on an investment company basis of $1,660,450 as compared with $1,249,532 in 1936, indicating an increase in interest and dividends received of $410,918.

Deduction of $216,590 for expenses and taxes gave net earnings of $1,443,860. This is equal to 2.14 times the funded debt and other interest charges of $675,178 in 1937. This compares with net earnings of $1,053,664 available for interest in 1936.

The balance of income available for dividends after all charges, including $60,000 reserve for employes' benefit fund and contingencies, amounted to $566,872 in 1937. This is equal to $7.07 per share on the total of 80,161 shares of 7 per cent and $6 first preferred stock outstanding. In 1936, earnings available for dividends were $117,339, equivalent to $1.46 per share of first preferred stock.

President F. S. Spring, of the Associated company, in his report to the stockholders, states that the operating companies showed a gain in stations but that investments in telephone companies in South America remain unsatisfactory, due principally to currency depreciation and transfer restrictions. The manufacturing companies as a group showed an increase in profits. The Automatic Electric Company wrote off against its 1937 earnings the balance of its patent expenses that had been deferred prior to 1934.

The combined taxes of the group were $360,000 in excess of 1936, an increase of 40 per cent. Of this increase, President Spring states that $115,000 applied to foreign and $245,000 to domestic companies. The domestic tax increase was 80 per cent over 1936, due to increased federal income taxes.

The combined assets of the subsidiaries of the Associated companies total $74,697,074. Of this amount $37,818,623 represent assets of the Anglo-Canadian Telephone & Telegraph Co. and subsidiaries and $8,497,695 represent assets of the Pan-American Telephone & Telegraph Co. and subsidiaries; while $28,380,756 represent assets of the manufacturing, sales and miscellaneous companies.

Answers to Traffic Questions on Page 17

1. The correct phrase is: "I will ring them again."
2. Five minutes on a built-up circuit.
3. Please refer to preface.
4. Prescribed subsequent attempt times are based upon experience and are considered the most favorable time for making attempts to complete delayed calls, taking into consideration the customer's wishes which are always carried out in regard to trying his call again if the offered time is not agreeable.
5. Yes, in many cases it is necessary and advisable to request the calling party to hold the line in exchanges where subscribers have not reached the point where they will hold the line when the long distance operator acknowledges the call by saying, "Thank, you." The majority of telephone users prefer to hold the line when placing a long distance call and some are critical if they are dismissed.

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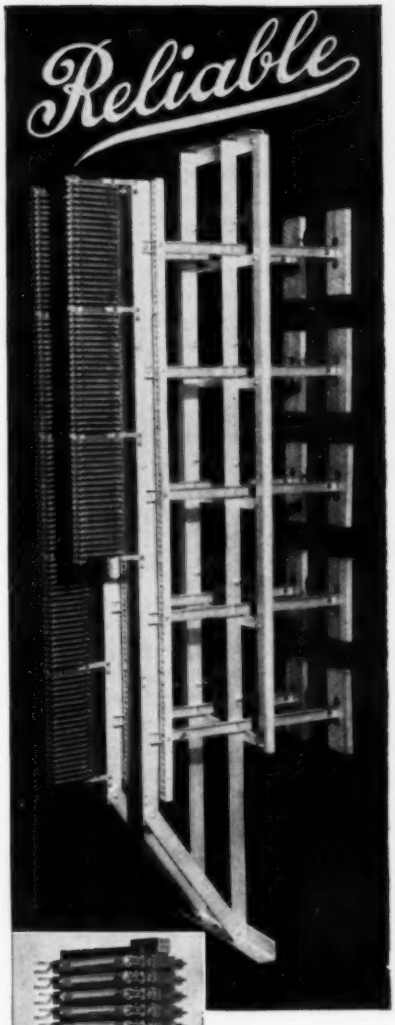
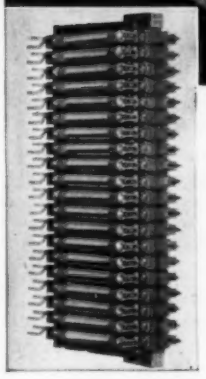
Mountain States Bell Files Bond Issue

The Mountain States Telephone & Telegraph Co. has filed registration statements with Securities and Exchange Commission under the securities act covering $30,000,000 of 3¼ per cent debentures due in 1968. The company plans to offer $27,750,000 of the debentures publicly, while the remainder will be sold privately to the Bankers Trust Co. as trustees of the company's pension fund.

Proceeds are to be used to repay in full the company's demand notes held by the pension fund trustee and also to repay in full advances from American Telegraph & Telephone Co., the parent company, and any balance of proceeds will be added to cash and used from time to time for plant and equipment.

Morgan, Stanley & Co. are expected to be principal underwriters. Names of other underwriters and the offering price will be filed by amendment.





The simplified design of the protectors gives the highest degree of protection at a low cost per pair.

The heat coil and all moving parts are enclosed in the fuse-like cartridge, free from dust and accidental opening.

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A complete line of standard frames for floor or wall mounting. See our latest catalog for further information or write to us for MDF bulletin.

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OVER 25 YEARS SERVICE TO THE UTILITIES

The Manufacturers' Department

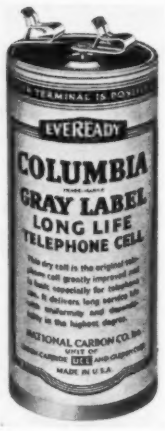
An Improved Telephone Dry Cell

The design of a dry cell for telephone work naturally must be based on an intimate knowledge of what the cell has to do. Leading battery manufacturers, working hand in hand with telephone companies, have acquired the knowledge of service conditions necessary to the design of a cell to meet those conditions. The extent to which a given type or make of cell meets telephone service conditions depends upon a number of practical factors, notably the ability of the manufacturer to incorporate as many of the desirable features as possible at a reasonable cost.

The principal characteristics, which it is agreed a good telephone cell should possess, are long life, well-sustained voltage throughout life, and a gradual decline in voltage toward the end of life rather than an abrupt break in voltage.

Long life is essential to operating economy. The cost of installing a cell in a subscriber's set may equal or exceed the cost of the cell. The less frequently installations have to be made, the greater the savings.

Sustained voltage means uniform transmission during the life of the cell. Transmission efficiency declines rapidly as the voltage applied to the transmitter falls off, and the cell which maintains its voltage at a high level for the greater portion of its life is the cell which enables management to render the most satisfactory kind of service to subscribers.



Improved telephone dry cell.

A gradual decline of voltage near the end of a dry cell's life gives ample warning that it must be removed from service. A cell which has a sharp "break" in its voltage curve may be responsible for unforeseen interruptions to service, with the attendant inconvenience, annoyance and expense involved in making emergency rather than routine scheduled replacements.

Telephone cells embodying these three and other essential characteristics to greater or lesser degrees have been on the market for many years. A point in the development of the telephone cell was reached a few years ago when it appeared that further improvements could be accomplished only at increased cost. What might be called "premium" cells were produced by the National Carbon Co., embodying long life, voltage maintenance, uniformity and dependability in a high practical degree. These cells cost more, but they were worth more.

Experience with these "premium" cells has made it possible for the National Carbon Co. to combine the best of their features in regular cells. This improved telephone cell, the outgrowth of years of experience, now replaces both kinds. It is not a new, untried, experimental product; rather, it is an improvement on an old, time-tested cell.

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New Supply Catalog of Leich Sales Corp.

"Telephone Construction Materials and Supplies" is the title of the new catalog recently published by Leich Sales Corp., Chicago, to cover the company's complete line of pole line supplies and exchange accessories. According to W. I. Fisher, president of the company, copies have been sent to more than 6,500 telephone companies throughout the world.

The scores of manufacturer's lines represented in the book include Cook and Reliable protective apparatus, Joslyn hardware, Klein tools, Potosi poles, Lenz cords, Acorn wires, Roebling cable, Acme visible indexes, Churchill and Sharon booths, Raytheon rectifilters, Electrox rectifiers, National Carbon and Ray-O-Vac dry cells, Exide, Gould and Philco storage batteries, National and Chance cable rings, Do-More chairs, Hemingray insulators and many other names and lines equally well known to the telephone field.

The catalog contains more than 125 pages and is printed on coated white stock. It is encased in a red cover, and the latest type of plastic binding is used to permit the book to lie flat at whatever page it is opened. According to company officials, the color—red—was selected for the cover to associate the catalog with the "Redbook" or "Where-to-Buy-It" idea in the minds of telephone men.

Copies of the new catalog may be obtained by writing direct to the Leich Sales Corporation, 222 W. Adams St., Chicago, Ill.

▼ ▽

Technical Director of Associated Electric Laboratories

Clarence E. Lomax, recently systems designing engineer for Associated Electric Laboratories, Inc., Chicago, has been appointed to the newly-created post of technical director of the laboratories.

In his new position, Mr. Lomax will

CLARENCE E. LOMAX, Chicago, has been appointed technical director of Associated Electric Laboratories, Inc.

LOWER PRICES ON HARDWARE!

The benefits of lower steel costs are immediately passed on to you in lower telephone hardware prices. Effective June 27th, all prices on pole line hardware shown in the price sheet of Leich's "Redbook" Catalog are reduced ten per cent. For quick service and a complete listing of quality telephone pole line hardware, refer to

Pages 15 to 22 of Leich's "Redbook" Catalog

TELEPHONE Construction Materials AND SUPPLIES
LEICH SALES CORPORATION CHICAGO, U.S.A.

LEICH SALES CORPORATION
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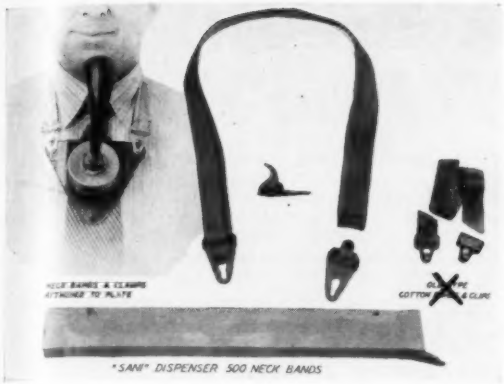
See The Redbook of the Industry



New sanitary paper neckband for telephone operators' headsets, manufactured by T. J. Cope, Inc., of Philadelphia, Pa.

have direct charge of all development work on automatic telephone circuits, systems, and equipment, conducted by Associated Electric Laboratories, Inc., for Automatic Electric Company and other associated companies. To this work he brings more than 25 years' experience in all phases of design, manufacture, installation and maintenance of automatic telephone equipment.

Mr. Lomax began his association with Independent telephony after leaving school in September, 1910, when he became maintenance man in the Strowger automatic exchange at Hastings, Neb. To secure an enlarged background of theory, he went to Chicago to take the students' training course at Automatic Electric Company, as a member of the class of 1912.

Then came further work with installation and maintenance at Lincoln, Neb., Portland, Ore., St. Paul, Minneapolis, and Indianapolis. Mr. Lomax was also one of a group of engineers selected and sent to England for work on the installation of Strowger automatic equipment there.

With this varied field experience, Mr. Lomax returned to Chicago, and in 1917 entered the engineering inspection department in the Automatic Electric factory. In 1919, he was transferred to the engineering department, and went to work on development of equipment for automatic operation of private branch exchanges and small public exchanges.

He had an important part in subsequent developments in automatic private exchanges and in unattended public automatic exchanges, and a number of patents have been issued on developments based on his work. In recent years, he has supervised all development work on circuits and switching systems for telephone exchanges.

▼ ▼

Sanitary Paper Neckband for Operators' Sets

T. J. Cope, Inc., of 6122 Vine St., Philadelphia, Pa., has just placed on the market an innovation in the way of a sanitary paper neckband for supporting operators' headsets.

This product is formed from a specially-treated paper which preserves its softness and adds to its absorptive qualities. It is designed to replace the cotton tape now universally used and to allow operators to have a fresh, clean neckband at least daily.

The neckband is attached to the headset breast plate with a clip which securely clamps the paper band and allows instantaneous adjustment to suit the individual operators' requirements. These neckbands are packed in cartons of 500 each, and a convenient dispensing cabinet to be hung on the wall is also a part of the equipment.

This sanitary paper neckband has had wide field tests and is said to have proved its value under all conditions by adding immeasurably to the operators' comfort. Low cost and the fact that every inch of it can be used only for the purpose for which it is designed are claimed to make economies attractive to both large and small consumers.

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New President of Oliver Iron & Steel Corp.

At the meeting of the board of directors following the annual meeting of the stockholders of the Oliver Iron & Steel Corp., held recently, Harry F. Devens, president for the past five years, was made chairman of the board, and Theodore F. Smith, executive vice-president, was elected president of the corporation.

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Manhattan Directories Weigh About 900 Tons

Weighing in all about 900 tons, or four times as much as the Statue of Liberty, approximately 587,000 copies of the Summer-1938 issue of the Manhattan (N. Y.) telephone directory have been delivered to subscribers in that borough by the New York Telephone Co.

NOW is the time to create NEW BUSINESS

Telephone pay stations have definitely proven their revenue-producing possibilities over the past 49 years. But today, more than ever before, alert telephone operators are realizing the tremendous potential profits (and all extra revenue) existing for them with Gray equipment. Every drug store, hotel, gas station, bus and railroad depot, cigar store, lodge hall, department store, library . . . in fact, wherever doors are open to the public, is an excellent location for a pay station. Whatever your requirements Gray has the exact equipment for your company.

Try this time-tested and proven method of obtaining extra business.

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GRAYBAR ELECTRIC CO., INC., New York, N. Y.
KELLOGG SWITCHBOARD & SUPPLY CO., Chicago.
LEICH SALES CORPORATION, 222 W. Adams Street, Chicago, Ill.
STROMBERG-CARLSON TELEPHONE MFG. CO., Rochester.
CANADIAN TELEPHONES & SUPPLIES LIMITED, Toronto, Montreal, Winnipeg and Vancouver.
NORTHERN ELECTRIC CO., LTD., Halifax, Montreal,

GRAY TELEPHONE PAY STATIONS

Telephone News Brevities

Telephones

MONTREAL, QUE., CAN.—At the end of April, net increase in telephone stations in Ontario and Quebec was just about 50 per cent of the increase in the like period of 1937 when the increase for the full year was 37,444 stations. Long-distance revenues of the Bell Telephone Co. of Canada for the first four months of 1938 are running 6 per cent below the like period last year. Overseas calls are down 10 per cent and trans-Canada long-distance traffic of Bell lines is slightly less than 5 per cent below the first three months of 1937.

LOS ANGELES, CALIF.—The Southern California Telephone Co. reports a net gain of 964 telephones during May compared with an increase of 2,582 in May, 1937. For the first five months of this year connections increased 8,875, against a rise of 22,546 in the first five months of 1937.

BALTIMORE, MD.—Chesapeake & Potomac Telephone Co. had a net gain of 1,392 stations during May compared with a net gain of 1,492 in May, 1937, and a net gain of 1,414 in May, 1936.

For the first five months of the year, the company had a net gain of 5,959 stations compared with a net gain of 9,083 in the like period of 1937 and a net gain of 7,341 in corresponding period of 1936.

NEW YORK, N. Y.—The New York Telephone Co. reports its number of subscribers increased in May by 4,040, compared with a gain of 13,840 for May of 1937.

For the first five months of this year the company had a net gain of 15,157 telephones in service, compared with an increase of 66,995 stations in the corresponding 1937 period.

NEW YORK, N. Y.—The General Telephone Corporation reports for its subsidiaries a gain of 1,978 company-owned telephones for the month of May, as compared with a gain of 3,133 telephones for May, 1937. The gain for the first five months of 1938 totals 6,690 (exclusive of purchases) or 1.84 per cent as compared with a gain of 12,434 telephones or 3.71 per cent for the corresponding period of 1937.

The subsidiaries now have in operation 370,103 company-owned telephones.

COLUMBUS, OHIO—As the result of a net gain of 196 telephones installed in May, the Ohio Bell Telephone Co. now has a total of 79,283 telephones in service in the Columbus exchange area. This made a total gain of 926 telephones for the first five months of this year. During that period 6,415 new connections were made while 5,489 were disconnected.

Last month's gain compares with a net increase of 856 connections in May, 1937; 242 in May, 1936; 187 in May, 1935, and 275 in May, 1934.

PHILADELPHIA, PA.—Bell Telephone Co. of Pennsylvania reports a net gain of 794 telephones in service during May, compared with a net gain in May, 1937, of 8,436. For the first five months of 1938, the net station gain was 8,304, against a gain of 44,293 in the like period last year.

The company reports that as of May 31, last, there were 1,213,430 telephones in service, against 1,178,985 on the same date last year.

Financial

HAVANA, CUBA — Operations of the Cuban Telephone Co. for 1937 resulted in net income of $230,868, compared with a loss of $114,385 in 1936, the annual report shows. The improvement is accounted for principally by an increase in telephones in service during the year, the report says.

Total operating revenues for 1937 increased 15.96 per cent, whereas operating expenses rose 4.72 per cent.

The company is a subsidiary of the International Telephone & Telegraph Corporation.

NEW YORK, N. Y.—The board of directors of the General Telephone Corp. on May 25 declared the regular quarterly dividend of 75 cents per share on the $3 convertible preferred stock, payable July 1, to stockholders of record at the close of business on June 15; also the quarterly dividend of 25 cents per share on the common stock, payable June 23, to stockholders of record at the close of business on June 10.

SUB-CYCLE

The MASTER Ringing Converter

MODEL "S"

PRICE $45.00

Equipped with Pulsator for Biased Ringing $55.00

Output 20 Watts, 90 Volts
Operates on 110 Volts A.C.

WILL HANDLE THE TOUGH JOBS

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NO MOVING PARTS

NO VIBRATING CONTACTS

NO ROUTINE MAINTENANCE

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SUB-CYCLE PROVIDES PERFECT RINGING SERVICE

(For loads 40/50 watts, write for information about Model "C.")

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ELECTRICAL COMMUNICATION

By ARTHUR L. ALBERT

Associate Professor of Communication Engineering, Oregon State College

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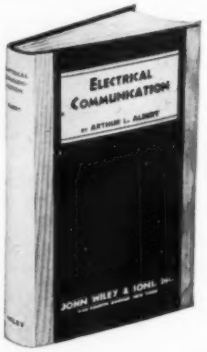

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Commission and Court Activities

City Ordinance Passed Against Coin-Boxes

The Fayetteville, Ark., city council recently passed an ordinance with an emergency clause prohibiting operators of telephone service companies from forcing the installation of pay telephones or coin-box telephones in certain business establishments.

The ordinance was passed after numerous complaints had been received from University of Arkansas students, accustomed in the past to place calls in downtown drug stores or other places of business. The students protested against installation of coin-box telephones.

Two years ago Fort Smith passed an ordinance prohibiting the placing of pay telephones in semi-public places by the Southwestern Bell Telephone Co. The company appealed to the commission, which ruled the ordinance invalid. The city appealed to the Arkansas Supreme Court, which upheld the commission.

In that case, however, the only question involved was whether the commission had authority to invalidate a city ordinance. Extensive testimony was not presented on the merits or demerits of coin telephone service.

At conferences with the commissioners, telephone company representatives have contended that placing of a telephone in a business house for free use by the public runs up operating costs, often necessitating employment of additional switchboard operators.

A statewide hearing in the matter was to be scheduled by the commission.

▼ ▼

Nebraska Commission Sets Depreciation Rates

The Nebraska State Railway Commission has issued a tentative order fixing at 3.18 per cent the authorized depreciation rate that the Northwestern Bell Telephone Co. shall set up on its books for 1938 operations. This being a reduction from the 1937 rate of 3.30 per cent, a hearing will be necessary. This has been set for July 14.

No change was made in the 1937 rate of 3.50 per cent for the Lincoln Telephone & Telegraph Co. and for the Nebraska Continental Telephone Co., and no hearings will be held unless objection is made.

The commission has been steadily reducing the Northwestern Bell Telephone Co.'s rate from a former high of 4.50 per cent, contending that in former years the company accumulated a depreciation reserve in excess of needs and that a proper interpretation of its reports to the commission indicates that the actual annual depreciation debits have not exceeded the figure fixed by the commission.

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Denied Right to Intervene In Ohio Bell Rate Case

Having heard arguments June 21, on the application of Earl Harrison, et al., of Cleveland, for authority to intervene in the Ohio Bell Telephone Co. state-wide rate case, which had been compromised on the basis of a refund of $7,500,000 and approved by the Ohio Public Utilities Commission on April 26, the commission on June 22 denied the application.

The commission held that the labor executives had no valid claim to enter the rate case since they were not parties to the original action litigated about 14 years ago. It was stated that the petitioners have had 14 years during which time they might have filed an application for leave to intervene, but which they did not do.

"No persuasive reason has been brought forward why they should now be permitted to enter this case," ruled

TELEPHONY'S Index for Volume 114

which was completed with the June 25 issue, is now ready for distribution among those who keep complete files. In this index are listed all of the important articles and items which appeared in TELEPHONY between January 1 and June 25, 1938. The index affords a ready reference and will be supplied free of charge to those making application.

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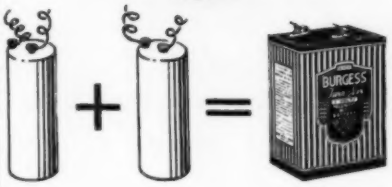

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Power-Line Crossing Requirements

The extensive rural power distribution systems now under construction warrant telephone companies taking a more active interest in high-tension crossings over telephone lines. Although it is not a telephone company obligation to check power-line crossings to determine if they have adequate strength to withstand maximum storm-loading conditions, nevertheless telephone companies must expect to take some action in the problem.

The National Electric Safety Code, as set up in Bureau of Standards Handbook No. 10, specifically prescribes the strength requirements for the various types of power-telephone crossings. In most states regulatory commissions have adopted the National Electric Safety Code rules as applying to construction within their state. It is the distinct obligation of a power company to design and build crossings which meet these requirements in order to insure safety to the public, to telephone employes and to physical property involved.

The many crossings created by rural public power lines in recent months have focused attention on the need for checking at least some of the many crossings created to insure that the power line construction is in conformity with the code.

A recent analysis by one large Independent operating company of approximately 400 miles of newly-constructed rural distribution line of the multi-grounded Wye type, discloses some startling conditions with reference to inadequately-built power-line crossings over telephone lines. In a typical public power district network, which was analyzed, more than 350 crossings were involved. A summary of these crossings showed results as follows:

Total Number of Crossings Summarized, 50

Crossings conforming to the National Electric Safety Code	3
Unguyed crossing poles requiring longitudinal guys	44
Unguyed crossing poles requiring transverse guys	4
Unguyed crossing poles requiring dead end guys	2
Guyed crossing poles requiring stronger longitudinal guys	1
Guyed crossing poles requiring stronger transverse guys	16
Guyed crossing poles requiring stronger dead-end guys	38
Crossing poles with single ties	15

These data illustrate the number and type of faults found with 50 typical crossings, but they do not show how bad the individual crossings proved to be. This is best shown by the detailed examination of a few typical crossings. For example, crossing No. 2, over a minor telephone line, involving four No. 2 aluminum power conductors utilized for pole No. 1, one having a ground-line circumference of 29 inches, whereas computations in terms of code rules show that a 49-inch pole, or equivalent strength guy, was required.

Pole No. 2 was a 42-inch pole, and computations show that a 54-inch pole or equivalent guy was needed. Pole No. 3, serving for dead-ending of a two-wire branch line off of the four-wire main line, carried a 3/8-inch Siemens-Martin strand with a lead-height ratio of only 0.215. Such strand is capable of holding 6,950 pounds. With the safety factor applied, and for the type of loading involved, the theoretical load on this guy with this small lead-height ratio would be 22,000 pounds; 3/8-inch guy strand and a lead-height ratio of 0.95 would have provided adequate guying in this instance. Even though the guy strand of adequate strength had been used, it is doubtful if the small anchor would have held up under the maximum load that might be expected.

Another crossing typical of those analyzed was No. 4. It consisted of four No. 2 aluminum conductors over a minor telephone line, and an angle in the line was involved. In this instance, computations showed that transverse guys were needed. The guy in place proved to be 3/8-inch Siemens-Martin strand with a lead-height ratio of approximately 0.46. Although able to hold only 6,950 pounds, the theoretical load imposed on the 3/8-inch guy in this crossing was 21,500 pounds.

These crossings were not hand-picked to illustrate the inadequate character of the crossing design from a strength standpoint, but are typical of the majority of crossings analyzed. They show beyond a doubt that, unless a more active interest on the part of the regulatory commissions or the involved telephone companies is taken, severe life and fire hazards will undoubtedly result from the apparent failure of at least some of the rural public power districts to comply with the National Electric Safety Code.

Considerable effort and cost are involved in checking an extensive power network to insure that all crossings comply

with the code. It certainly is not the obligation of telephone companies to do this. However, from a practical standpoint it appears that a sampling of power crossings will need be made by telephone companies.

Code Definitions and Construction Grades

In order to reduce life and property hazards the National Electric Safety Code specifies the grade of construction required for power lines at power-telephone crossings. The minimum size pole, guy strength, and wire tensions and methods of support are specifically prescribed for each type of power line crossing.

The strength requirements vary for different types of crossings. In general, the highest voltage power lines require the strongest construction; likewise power lines of a given voltage built over multi-wire telephone lines must have greater strength than crossings over only two and four wire telephone lines.

Handbook No. 10 of the Bureau of Standards, table No. 14, shows for the several classifications of power lines the exact grade required. The grades are designated as A, B, C, and N; grade A being the strongest and N representing the minimum strength requirements.

Telephone lines are separated into three classifications: (1) *Minor telephone lines,* which are those carrying not more than two circuits and used primarily for local telephone or telegraph service; (2) *major telephone lines,* which are those carrying more than two circuits or carrying any number of toll wires; (3) *paired drop wire telephone lines,* which are those requiring the minimum construction strength in power structure.

Table No. 14, as shown in the handbook, can be simplified for telephone purposes by considering only situations where power conductors are over telephone lines. With this simplification the accompanying table lists the grade of construction required for any one of the three types of telephone line, and for power lines in two voltage classifications.

After determining the grade of construction required at any power line crossing, the next thing required to be known is the safety factor prescribed by the code for these particular grades. A simplification of that portion of the code which specifies safety factors for the various grades is shown in the code table No. 14 to be published next week.

the commission. "To let individual subscribers enter a case of this sort—and particularly after its decision—would create nothing but confusion. The authorities are perfectly clear that they are not only without standing to insist upon the right to be made parties, but that it is the duty of the commission to deny them that privilege."

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Increased Rates Approved for Non-Paying Exchange

The Nebraska State Railway Commission has authorized the Lincoln Telephone & Telegraph Co., whose headquarters are at Lincoln to place in effect, as of April 6, at its Union exchange these monthly net rates: Business one-party, $3.00; business extension, $1.00; residence one-party, $2.00; residence two-party, $1.75; residence extension, 50 cents; business ten-party or farm, $2.25; residence ten-party or farm, $1.75.

Evidence presented by the company showed an average out-of-pocket cost of operation for the last ten years of $631.38. On the basis of number of telephones in service November 1, 1937, the company estimated a return of $278, or 1.8 per cent on the book cost under the new rate schedule. The company showed that as the result of construction and operation of power lines and circuits in the neighborhood of the exchange, so much inductive interference has appeared as to necessitate the metallicizing of the plant at a cost of $5,000.

Subscribers presented two petitions, one group asking for change of type of service and agreeing to pay the increased rates. The other group requested that the company not be permitted to change the type of service if that were accompanied by a raise in rates.

The commission finds, however, that even though the company did not intend to metallicize its Union property, it is apparent from the evidence that authorization of the proposed rate could not legally be withheld. Rates that do not produce, in excess of bare out-of-pocket operating expenses, without adequate return on investment, are not unreasonable to the ratepayers, the commission concludes.

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Competition at Jesse, Okla., Finally Settled

An extended controversy between R. C. Simpkins, operator of telephone lines and exchanges in various parts of Oklahoma, and the Southwest Telephone Co., owning and operating toll lines and exchanges in southern Oklahoma, apparently was settled by an order of the Oklahoma Corporation Commission, June 16. The order denied application of the Southwest Telephone Co. for a certificate of convenience and necessity to operate a local telephone exchange at Jesse, Pontotoc county, and confirmed the right of Mr. Simpkins to operate an exchange there.

For 30 years the Southwest Telephone Co., and its predecessors owned a toll line to Jesse but had no exchange there. In February, 1935, the commission denied the application of Mr. Simpkins to build an exchange at Jesse. However, in November, 1935, he constructed an exchange in Jesse and two weeks later the Southwest company also built an exchange there.

Mr. Simpkins was cited for contempt of the commission order and fined. He appealed to the Oklahoma Supreme Court, which held that the commission order was void and that the commission was without authority to prohibit the building of lines and exchanges in unoccupied territory. The Southwest Telephone Co. owns an exchange at Stonewall, four miles north of Jesse, and Mr. Simpkins owns an exchange at Fittstown, seven miles northeast of Jesse.

The commission found that Mr. Simpkins has six subscribers and the Southwest Telephone Co. twelve subscribers in Jesse and that this amount of business does not justify the operation of two exchanges there.

Nebraska Awaits FCC's System of Accounting

Nothing official or final will be done by the Nebraska State Railway Commission in connection with its proposed revision of the uniform system of accounting for telephone companies having less than $50,000 of annual revenues until after the Federal Communications Commission has blazed the way.

This was the decision reached at a conference recently held in Lincoln, Neb., by Chief Accountant John H. Schnell with a committee named from the Nebraska Telephone Association, at the request of the state commission. The committee is made up of President D. E. McGregor, of Gibbon; Secretary George M. Kloidy, of Lincoln; D. M. David, secretary of the Farmers Telephone Association of Hamilton County, C. L. Kelly, secretary of the Farmers Telephone Co. of Dodge County, I. J. Devoe, general auditor of the Lincoln Telephone & Telegragh Co., and V. Bellows of the Blair Telephone Co. Mr. Bellows was the only committee member who was absent from the meeting.

Meanwhile, Accountant Schnell will accompany Secretary Kloidy on visits to the various telephone companies affected for the purpose of discussing the proposed system with the managers,

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and obtaining their criticisms, suggestions and recommendations that are desired to be observed in connection with its promulgation.

After contact has been had with the telephone interests, the accounting department is to formulate a tentative draft of a uniform system of accounting for telephone companies having average annual operating revenues not exceeding $25,000 a year. A draft for telephone companies having average annual revenues between $25,000 to $50,000 per year is to be formulated after receipt of the final draft of the FCC's system for Class C companies.

This latter division was the subject of considerable discussion, and most of it was favorable. This would bring into a separate classification companies having headquarters at Falls City, Aurora, Blair, Crete, Gibbon, North Bend and Wisner. It was believed that such a classification was desirable as a system applying to all under $50,000 a year would not fit the situation with those in the larger subdivision.

It was agreed by all that it would be advisable to await the final drafting of the system of accounting for companies having less than $50,000 a year that is now in tentative form before the Federal commission, and to pattern the Nebraska system after its classifications as nearly as is practical to do so. Some of the objectionable features of that tentative draft for class C companies were the so-called original cost theory, the perpetual inventory plan and the prescribed expense accounts.

Another suggestion was that perhaps there should be more than one classification for companies having less than $25,000 average annual revenue but no agreement was reached upon that point.

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Valentine Clark Corporation, 2516 Doswell Ave., St. Paul, Minn.—Finishd Cedar Poles. Plain or butt-treated.

Application to Transfer Toll Point Denied

The Oklahoma Corporation Commission, June 16, denied the application of Troy Simpkins to establish Pryor, Okla., as the transfer point for toll business between his toll line from Disney, Okla., and toll lines of the Southwestern Bell Telephone Co.

Mr. Simpkins owns and operates a telephone exchange at Disney and in conjunction with Guy Hall owns a toll line extending from Disney to Topsy, Okla., where it connects with a toll line owned by R. C. Simpkins, a brother of Troy Simpkins. The latter line extends from Topsy to Salina, Okla., and thence to Pryor, Okla.

Troy Simpkins has an agreement with his brother to use the latter's line. R. C. Simpkins owns the local exchange at Salina and the Southwestern Bell company owns the exchange at Pryor. The latter company also owns toll lines running through Salina, where connection is made with the Simpkins exchange, and also owns toll lines connected to the Pryor exchange.

Mr. Simpkins and Mr. Hall, in their petition, contended that toll service would be improved if transferred through Pryor rather than Salina. The commission, in denying the Simpkins-Hall petition, declared that this service could be improved by correcting the difficulty in getting night calls through the Salina exchange owned by Simpkins and that there then would be no necessity to transfer through Pryor.

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Summary of Commission Rulings and Hearings

Illinois Commerce Commission

June 27: The request of the village board of Shiloh, St. Clair County, that the Southwestern Bell Telephone Co. serve the community from its Belleville exchange was rejected by the commission. The commission held that a cost of $1,130 to the Bell company to serve eight customers was not within its price schedule and would be an invasion of the territory of the Smiley Brothers exchange.

Missouri Public Service Commission

June 25: Applications filed by the Western Light & Telephone Co. for authority to file a schedule of rates for telephone service at Bevier, Callao and New Cambria, Macon County.

June 27: Application filed by the Western Light & Telephone Co. for authority to file a schedule of rates for telephone service at Monticello.

Nebraska State Railway Commission

June 22: In the matter of depreciation rate to be set up on the books of the Northwestern Bell Telephone Co. for 1938, ordered that it be fixed at 3.18 per cent; for Lincoln Telephone & Telegraph Co. and for Nebraska Continental Telephone Co., 3.50 per cent.

June 24: Application of the Lincoln Telephone & Telegraph Co. for revision of rules with respect to service for employes, found reasonable and granted.

June 24: Application of the Lincoln Telephone & Telegraph Co. for revision of rates and rules relating to length of cords and other appliances, granted as asked.

June 24: Application of Curtis Telephone Co., of Curtis, for authority to issue $3,475.34 of bonds to take up short-term notes given in payment of telephone building recently purchased, filed by Secretary B. C. Berch. Assets are listed at $21,588, depreciation reserve at $15,000 and it is stated that of the $10,000 authorized stock, only $2,200 has been issued.

July 14: Hearing on commission's tentative order fixing the 1938 depreciation rate of the Northwestern Bell Telephone Co. at 3.18 per cent.

Ohio Public Utilities Commission

June 20: Authority granted to the Mt. Vernon Telephone Corp. to file a new rate schedule for all exchanges.

June 20: Authority granted to the Ohio Bell Telephone Co. to revise its base rate area boundaries for its Bedford exchange to include new developments and to exclude certain undeveloped territory.

The company was also given authority to amend its toll route guide to change the toll station at Eureka to a subscriber station on the Gallipolis exchange, and to change Long Bottom and Success from Coolville subscriber stations to rate centers.

June 20: Conditioned that resultant therefrom the applicant be released from all further indebtedness on account of $2,950 unpaid balance of consideration for real estate at Greenfield and $19,200 advances from affiliated companies, the Greenfield Telephone Co. was authorized to issue and sell at par $19,550 of 10-year 6 per cent notes.

The company had asked to issue $20,400 of such notes to cover plant additions from April 1, 1928, to December 31, 1937.

June 22: Order issued refusing to reconsider the Ohio Bell Telephone Co. rate case settlement decision as requested by counsel representing a group of Cleveland labor union officials.

June 23: Permission to file a new schedule for its Wickliffe exchange in Lake County was granted to the Ohio Bell Telephone Co.

The new schedule extends to the south the base rate area and creates a new locality area in the territory north bordering Lake Erie wherein it will hereafter furnish, in addition to the standard rural line service, the established business individual, and business two-party, and residence individual and four-party service prevailing in the Wickliffe base rate area.

June 24: Authority granted the Northern Ohio Telephone Co. to publish, effective October 1, new classifications, when its new automatic exchange at Marblehead will be put into service.

June 29: Hearing on application of the United Telephone Co., of Bellefontaine, for permission to issue and sell at par, $375,000 first mortgage 20-year bonds, the proceeds to be used to retire the company's outstanding $295,000 preferred stock and in lieu of $61,900 such stock previously authorized but not issued to reimburse its treasury for uncapitalized capital expenditures.

Pennsylvania Public Utility Commission

June 29: Further hearing in Philadelphia before Chairman Driscoll and Commissioner Beamish in the commission's inquiry and investigation upon its own motion, of the Bell Telephone Co. of Pennsylvania for the purpose of determining whether or not the respondent company has violated Section 408 of the provisions of the public utility law.

June 29: Further hearing in Harrisburg before Commissioner Beamish on application of the Bell Telephone Co. of Pennsylvania for approval of the construction, installation and operation of an addition and improvement to its existing plant in the community known as Perrysville, Allegheny County, and of its contracting with Western Electric Co., Inc., an affiliated interest, for the purchase of certain equipment and facilities necessary thereto.

June 30: Further hearing in Harrisburg before Examiner Light on the complaint of the Pennsylvania Department of Highways against the American Telephone & Telegraph Co., the Bell Telephone Co. of Pennsylvania, county of Cumberland, Harrisburg Gas Co., Pennsylvania Power & Light Co., the Pennsylvania Railroad Co., Riverton Consolidated Water Co., Valley Railways Co. and West Fairview.

The complaint set forth the alleged dangerous and inadequate condition of crossing where State Highway Route No. 30, leading from Wormleysburg to and through the borough of West Fairview, is crossed below and under the highway grade by two tracks of the Pennsylvania Railroad Co. near the intersection of West Street and State Highway Route No. 30 in the borough of West Fairview, Cumberland County.

Wisconsin Public Service Commission

June 27: Hearing at the Oshkosh courthouse on application of the Wisconsin Telephone Co. for authority to buy and the Winnebago County Telephone Co. for authority to sell certain telephone property to the Wisconsin Telephone Co.

June 27: Hearing at the Oshkosh courthouse on application of the Wisconsin Telephone Co. for permission to apply its rates in force and effect in its Oshkosh territory to subscribers of the Winnebago County Telephone Co. upon acquisition of the property of such company.

July 6: Hearing in Madison in the investigation, on motion of the commission, of the charges made for handset service by Class A, B, and C telephone companies, operating in Wisconsin (further hearing).

July 7: Hearing in Madison in the state-wide investigation, on the commission's own motion, of the rates, rules, service, practices and activities of Wisconsin Telephone Co. (handset rates).

July 7: Hearing in Madison, on the complaint of Louis Podell et al., against the Wisconsin Telephone Co. (handset rates).

July 9: Hearing in Madison in the investigation, on motion of commission, of rules for extension of service and line facilities at the exchanges of the Commonwealth Telephone Co. (further rehearing).

July 11: Hearing in Madison in the investigation, on motion of commission, of the public convenience and necessity required in the requested extension of service of the Equity Telephone Co. in the village of Frederic (rehearing).

July 11: Rehearing in Madison on alleged refusal of the Equity Telephone Co. to extend its lines to serve the Frederic Pharmacy in the village of Frederic.

OBITUARIES

G. T. CORL, auditor of receipts, of the Central Group operating companies of General Telephone Corp., died in a hospital at Madison, Wis., on May 22 following an operation for appendicitis.

Mr. Corl was born December 21, 1894, in Pleasant Gap, Pa., and first became associated with the telephone industry in 1918 when he entered the employ of the Central Union Telephone Co., Chicago, Ill., as an accountant. In 1922 he was transferred to the accounting department of the Illinois Bell Telephone Co. and continued to serve that company until 1927 when he resigned to accept a position as general auditor of the United Telephone Co. at Coldwater, Mich.

Coincident with the purchase of the United Telephone Co. by the Michigan Associated Telephone Co., Mr. Corl accepted the position of division auditor of receipts at Goshen, Ind., where he supervised the revenue accounting for three of the operating subsidiaries of General Telephone Corp. On August 1, 1937, he was promoted to the position of auditor of receipts of all of the Central Group companies and was serving in that capacity when he died.

Mr. Corl was well known in Michigan and Indiana where he gave untiringly of his efforts in the solution of many toll and exchange accounting problems. In the short time he was stationed in Madison, Wis., he gained the friendship and respect of all those with whom he came in contact.

He was a member of The American Museum of Natural History, American Nature Association, Rotary International, and Elks. Survivors, besides the widow, are a son, Robert J., Chicago; two daughters, Margaret, Madison, Wis., and Mrs. John I. Fudenski, Sacramento, California; the parents, Mr. and Mrs. J. H. Corl, Chicago; a brother, Carl, Chicago; and three sisters, Mrs. Fred Dillon and Mrs. John Sipple, Chicago, and Mrs. Perry Arnold, Browning, Ill.

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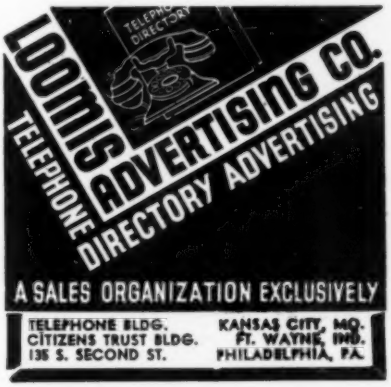
HUGH LaMASTER, age 68, who for 18 years was attorney for the Nebraksa State Railway Commission, died suddenly last week at his home in Lincoln from an attack of angina pectoris. Mr. LaMaster was widely known in Nebraska in the field of telephone management, and the helpful attitude he assumed toward the problems of the industry contributed to the peaceful relations between operators and the commission for a number of years. He was a native born Nebraskan, a graduate of the University of Nebraska and of Columbia University. Since his retirement from public service four years ago he had been in active practice in Lincoln, Neb.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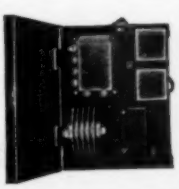
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